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King George The Fifth

THE long annals of the British monarchy contain no parallel to the volume of personal grief which has been called forth by the death of King George V. No man, woman, or child, of the uncountable millions of our fellow-subjects throughout the Empire who were linked by wireless on Monday night in a common bond of mourning, almost as it seemed at the King's death-bed, can ever forget that intensely solemn and intimate experience. To most of the listeners it was not merely the death of a sovereign; it was the passing of a man in whom all recognised the title to fatherhood of the Imperial family, which the King, with proud humility, had accepted in one of his Christmas broadcasts.

If it is the man who was chiefly mourned at the moment of his passing, it is the King who hardly made a single mistake as a constitutional monarch in times of unexampled difficulty, who will go down to history. It can fairly be claimed for King George that he threw aside the last vestiges of mediæval monarchy and brought the greatest of British institutions into line with modern sentiment. He had a liberal mind in the finest sense of the term, and he made an adjustment of the relations between hereditary kingship and the democratic institutions over which he presided, which has made both infinitely stronger for the tasks they have to discharge in a changing world. His special qualities were not those of a commanding genius, but were an intuitive reaction to the special qualities of the normal Briton. Industry, common sense, courage, good humour and a spirit of compromise were his in such a high degree that there seemed to emanate from him the perfect essence of the British temper.

In the realms of business, industry and economics generally, the quarter of a century of King George's reign stands out as an era by itself. It has witnessed scientific and mechanical changes on a scale and at a

rate which were wholly inconceivable when the King ascended the throne, with the result that at the end of the reign the products of industry and the common amenities of life available to the people as a whole, bear very little resemblance to the corresponding factors which existed in 1910.

The Georgian period can claim the full credit for the organisation of industry, and especially for the machinery of conciliation between capital and labour, all of which were unthought of in 1910. Against these historic advances in the comfort and convenience of life

must be set the fact that the King's reign also witnessed a phenomenal growth of the political power which has reduced many of the countries of the world to ruin and altered the character of the daily life of the rest. King George and his people, almost alone among the peoples of the world, can claim some measure of success in the difficult task of carrying on with the practical work of life, whilst also conducting widespread experiments in political ideas.

King George was the first occupant of a throne in all the centuries of the monarchy's history to possess any real personal knowledge of the problem of industry, and the conditions under which it had to be carried on. As Prince of Wales, and later as King, he missed no opportunity

to penetrate into the practical side of the people's problems. It is perhaps to the personal knowledge acquired in that strenuous way that we must attribute the wise guidance which he has constantly been able to give to statesmen of all parties, who, because of their party limitations, were less able to see any particular problem from all sides.

In these latter respects the new King has not only followed in the wise footsteps of his father, but has trod this interesting road much more frequently and to far greater lengths.



Notes and Comments

King Edward The Eighth

KING EDWARD THE EIGHTH assumes his tremendous responsibilities at an age which is generally accepted as finding a man at the height of his powers. A man in the early forties has a certain maturity of experience and at the same time has not lost his freshness of outlook and the keen edge of his activity. The spirit in which His Majesty enters upon his sovereignty is epitomised in his declaration to the Privy Council on Tuesday: "When my father stood here twenty-six years ago he declared that one of the objects of his life would be to uphold constitutional government. In this I am determined to follow my father's footsteps and to work as he did throughout his life for the happiness and welfare of all classes of my subjects. I place my reliance upon the loyalty and affection of my people throughout the Empire, and upon the wisdom of their parliaments, to support me in this heavy task, and I pray that God will guide me to perform it."

The reign of King George V was marked by one of the most devastating catastrophes in history. The late King did more than any other single man to ameliorate the distresses caused by the great war. The prayer of the Empire to-day is that the new Edwardian epoch that lies ahead will be one of peace abroad and growing contentment at home. The people already feel that they know the new King almost as intimately as his father, and they confidently rely on him to act in the same spirit and to tread the same path to the glory of his Empire and the happiness of his people.

The Government Chemist

SIR ROBERT ROBERTSON, who retires from the post of Government Chemist on April 17, has spent almost the whole of his career in the Government service. For fifteen years he was a chemist at the Waltham Abbey gunpowder factory, where he carried out important investigations on the stability of cordite, and from there he went to Woolwich as director of explosives research in 1907. For his work there during the war he received his K.B.E. and he was also elected to the Royal Society. During his fifteen years' work at the Government Laboratory in Clement's Inn Passage the work of the department has grown enormously. The Laboratory now undertakes work for nearly every Government Department, and more than half a million samples are dealt with in the course of each year. A laboratory was originally established in 1842 at Somerset House, in connection with the Inland Revenue Department, with the object of checking the adulteration of tobacco. The scope of the laboratory was gradually extended so as to embrace the analysis of almost every excisable commodity. The custom house was also provided with a laboratory in which wines, spirits and other articles liable to duty on importation were examined. In 1894 the two laboratories were amalgamated under one principal and were thenceforward known as the Government Laboratory. The work of the excise branch of the laboratory was transferred in 1897 from Somerset House to the present building in Clement's Inn

Passage. Outside his official duties, Sir Robert Robertson has carried out researches on the infra-red spectra of ammonia, phosphine and arsine, and his investigations of diamonds led to the discovery that there are two varieties of this precious stone with distinctive atomic structures. In 1926-29 he was secretary of the Royal Institution, and since then he has been its treasurer.

Improved Chemical Trade in 1935

THE Board of Trade returns issued last week confirmed the optimism expressed a month ago in regard to the expansion of British overseas chemical trade in 1935. Exports of chemicals, drugs, dyes and colours for the twelve months totalled £20,420,133, an increase of £863,588 over 1934 and an increase of £1,852,437 over 1933. India was our largest customer with a total of £2,798,462, against £2,423,558 in the previous year, followed by Australia £1,759,640 against £1,542,362, South Africa (£1,367,669 against £1,344,993), Canada (£1,182,827 against £1,221,818) and the Irish Free State (£1,012,661 against £987,943). It will be observed that Canada was the only large British dominion to show a decrease in comparison with 1934. The year's imports of chemical products totalled £11,941,031, showing an increase of £651,051 over 1934 and £2,017,535 over 1933. By far the largest individual share of our imports came from Germany, amounting to £3,630,411 against £3,598,741 in the previous year. The United States were second on the list with a total of £1,939,206 against £1,826,758. Although the favourable balance of trade (excess of exports over imports) was only £212,557 greater than in the previous year the figures are, on the whole, decidedly encouraging and there is every reason to hope that the upward trend will be continued throughout the new year.

Fewer New Chemical Companies

A CONSIDERABLE decrease in the number of new chemical companies is revealed by a statistical report on chemical registrations at Somerset House, just issued by Jordan and Sons, Ltd. New companies of every description increased from 12,475, with an average nominal capital of £11,506, in 1934, to 13,103, with an average nominal capital of £10,427 in 1935, but new companies engaged in the chemical industry registered in the same period fell from 568 to 498, and the average nominal capital also fell from £9,715 to £7,074. In 1933 no fewer than 601 new chemical companies were registered, but the total capital was only £1,648,720, representing an average of £2,743 per company. Nine of the new chemical companies registered last year were public companies with an average nominal capital of £129,005, leaving 489 private companies with an average capital of only £4,829. In 1934 eight public companies had an average nominal capital of £399,762 and 560 private companies had an average of £3,969, whilst in 1933 there were eleven registrations of new public companies, averaging £21,440 each, and 590 private companies with an average of £2,294.

King George and the Chemical Industry

Events During his Memorable Reign

His MAJESTY KING GEORGE V, whose passing on Monday night at the age of seventy years cast the nation into deep and sudden mourning, had no more loyal subjects than the thousands of people engaged in chemical science and industry. Less than twelve months before he came to the Throne he had, as Prince of Wales, opened the Seventh International Congress of Applied Chemistry which met in London. Subsequently, His Majesty, on his accession, accepted a loyal address from the Society of Chemical Industry, and in doing so assured chemical science in all its branches of his continued interest. Throughout his twenty-five years' reign, therefore, there was a happy link between the Crown and the industry. Although, of necessity, it was only on rare occasions that His Majesty came into direct personal contact with chemical activity, there was from first to last a consciousness of his desire for its furtherance and progress—a desire which repeatedly found expression in his gracious consent to bestow his patronage upon important chemical congresses, in his grant of Royal Charters to societies formed for the promotion of chemical and allied sciences, and in his acceptance of messages of loyalty addressed to him on notable occasions during his beneficent reign. Of such messages the most recent was that sent by the Institute of Chemistry on the occasion of its Charter Jubilee last July, in response to which the following reply was read at a dinner attended by Princess Alice, Countess of Athlone, and the Earl of Athlone: "The King has received with much pleasure the loyal message of greeting from the Institute of Chemistry who are to-day assembled to celebrate the jubilee of their Royal Charter. His Majesty thanks them sincerely and sends his congratulations on this memorable occasion, together with his best wishes for the continued prosperity of the Institute."

In 1912 His Majesty, accompanied by the Queen, toured industrial Yorkshire. On July 9 the first place visited was the Silverwood pit of the Dalton Main Collieries, Ltd. Here the King watched with great interest the processes of screening and washing; he went over the engine-house and the coke ovens and inspected the by-product plant. The next halt was at the model village of Woodlands, which belonged to the Browsworth Main Colliery Co. Their Majesties then went through several more mining villages where the Queen showed a great interest in the miners' homes and actually went over one of them. At the Elsecar Colliery the King, accompanied by Lord Fitzwilliam, descended to the bottom of the shaft, a depth of some 350 yards, to the great delight of the miners.

Lord Fitzwilliam conducted the King over the mine and he congratulated the pitboys on the plump appearance of

their ponies. His Majesty then borrowed a pick from one of the miners and started to work at the face for himself. He soon discovered, and remarked upon, how much easier the soft coal was to "get."

On July 10 the Royal couple continued their tour for another forty-six miles. They arrived at Stairfoot in the morning and inspected the works of the Rylands Glass and Engineering Co., and watched with great interest the processes by which the molten glass was moulded.

The next visit was paid to the wire rope works of G. Craddock and Sons. From there they went to the fuel economiser works of E. Green and Son. At the King's request Sir Edward Green granted all his employees a half-holiday. His Majesty took a great interest in the various processes employed and had the entire plant explained to him. Their next and last visit was to the premises of the Seamless Boat Co.

Under no other sovereign has the chemical industry and the practical application of chemistry made such progress. Since 1910 the number of chemical organisations has vastly increased and the older societies have undergone drastic changes.

The development of the chemical industry during the twenty-five years has been dominated by the war and by its after-effects. That, of course, is true of any industry, but it is so in a special way of the chemical industry. Before the war it was largely in the hands of Germany, but within a few years a great British chemical industry was built—an industry that unlike many another war-time creation could turn its

equipment to useful purposes after a tribute to our chemists and engineers that whatever was necessary was done successfully, research was intensified, men were trained, plant was designed and constructed, so that by the end of the war we were in a position to compete in the international market.

The following message has been sent to King Edward VIII by the general secretary of the British Association of Chemists: "My council and the members of this Association desire respectfully to convey an expression of their deep regret at the death of your august father, His Majesty King George V. That regret is the deeper having regard to the interest which His late Majesty is well known to have taken in the advance of the chemical and other sciences both pure and applied, and my council have directed me to express to Your Majesty the deep sense of loss which they and every member of the Profession of Chemistry feel on this occasion. I am to add that they would wish to convey to Your Majesty personally a sincere expression of sympathy in your loss."



This photograph of His Majesty King George visiting the works of George Kent, Ltd., at Luton, in 1917, typifies the interest he took in industry and the cordiality with which his visits were always regarded.

Laboratory Chemicals and Organic Reagents

How Manufacturers Overcame Difficulties

IN these days of specialisation the analyst looks to the chemical manufacturer for a supply of reagents to cover the most exacting requirements in respect both of purity and range. It was at one time recognised that the purity even of the best chemicals on the market fell far short of analytical needs. The analyst in many instances would need to submit products to recrystallisation or other suitable process of purification in laboratory apparatus of glass or porcelain. Since that time many new resistant materials have come into use in chemical engineering. Special enamels for iron and steel vessels confer on them resistant qualities equal to the best laboratory glassware. A multitude of new alloys and other materials now available to the fine chemical manufacturer enable him to reproduce results that were formerly considered attainable only in the laboratory. Not the least factor is the enterprise of the manufacturer who has availed himself of the best materials and appliances and has evolved works methods providing the utmost precautions against contamination.

"AnalaR" Standards

Does this mean that the analyst may blindly accept the chemical manufacturer's product on his assurance that it is pure enough for analytical requirements? The analyst of all people must be well assured of the foundation on which his work stands; and purity of his reagents is one of the chief factors governing the accuracy of his work. The old-time chemist who prepared or purified his own reagents knew practically all there was to be known about the product, and nowadays a reagent purchased with no more information than that it is of reagent purity must be fully tested by the user before he may be assured of its suitability for his particular purpose. The only product which may be considered fully satisfactory is that which is supplied with complete details of the schedule of tests which the manufacturer requires it to satisfy. A range of such products is now available under the protected name "AnalaR," and complete specifications for these reagents are published in "AnalaR" Standards for Laboratory Chemicals, issued jointly by The British Drug Houses, Ltd., and Hopkin and Williams, Ltd.

Each monograph in this publication sets out the precise conditions of the tests, each of the limit type, which are applied to every batch of material, together with a numerical interpretation of the limit in terms of possible percentage of each impurity. These figures are duplicated on the labels of these products so that the user who does not wish to equip himself with the books of specifications may have the utmost possible information on his bottle. Most analysts will, however, probably prefer the fuller practical particulars detailed in the publication.

Specifications of Varying Types

The specifications are of varying types. A given reagent has perhaps only one or two recognised uses, and in such a case the specification may be based on that particular analytical process comprising, in fact, a suitable "blank" or series of blanks to satisfy the known requirements for that process. Sodium bismuthate for manganese determination and soluble starch for estimation of diastatic activity of malt are examples of this class. A far greater class is capable of manifold uses and the makers' tests must be correspondingly more searching. At the other end of the scale we have those chemicals which are intended for standards in volumetric results in agreement with super standards. In the laboratories of Hopkin and Williams, Ltd., these products are carefully compared with super standards which have been several times recrystallised after yielding negative results in the usual tests for impurities.

Progress in analytical chemistry is continually leading to more and more accurate methods, but the one proviso is generally to be taken into account, that the reagents must be of purity commensurate with the accuracy claimed. It is therefore found that the reagent manufacturer must make his specifications more and more stringent. He must also keep pace with such progress by issuing frequent additions to his range. The growing importance of hydrogen ion determination has resulted in the addition of all the necessary buffer substances of sufficient and specified purity. Certain well-established organic reagents, such as dimethylglyoxime and 8-hydroxyquinoline have also found a place in the "AnalaR" range. There have also been included certain substances not generally considered as important from an analytical standpoint, but which are at times required in a highly pure condition for research work. Altogether the "AnalaR" range comprises over two hundred chemicals, the greatest range ever issued in this country to a published specification.

The unification of the specifications previously published separately by the two firms has achieved the object of defining a set of up-to-date standards which have been based upon expensive practical experience in the manufacture and testing of the more important inorganic and organic compounds employed for scientific work. In the preparation of the specifications full advantage has been taken of recent advances in analytical practice, and many new and delicate tests have been devised. Many of the former "A.R." specifications have been made more stringent, while others have been more accurately defined. Users of "AnalaR" chemicals can therefore feel satisfied and reassured by the knowledge that the standards of purity are definite and precise. Details of the tests which have been worked out for the detection of minute traces of various impurities are described with particular care, so that accurate results may be obtained by analysts working independently in different laboratories.

A Separate Path to Avoid Confusion

In 1925, The General Chemical and Pharmaceutical Co., Ltd., recognising the confusion which existed also gave attention to the question of purity standards with a view to issuing a new and up-to-date specification book covering a wide range of products offered under their registered trade mark "Judex," and including specifications of materially greater stringency than had been available previously.

This company states that it sought the best available advice on the matter in question with the result that it was requested to refrain, if possible, from issuing yet another book of specifications. It was pointed out that to publish such a book would add to the confusion already existing owing to the many varying specifications extant. It was further realised that, no matter to what extent the proposed specifications represented higher purity standards, they would still remain the product of a manufacturing interest and therefore without any official or independent status. It was also recognised, so they state, that no official body could countenance the use of a private trade mark in substitution for the letters "A.R." as a general description of chemicals suitable for use as analytical reagents. The combination "A.R." is therefore and is likely to remain the only designation of analytical reagents acceptable to official bodies and chemists generally.

The General Chemical and Pharmaceutical Co., Ltd., whilst realising the urgent need of more stringent specifications for A.R. material felt that the advice it received on this occasion was sound in every way, and it was therefore faced with the problem of achieving its object of obtaining higher purity standards for A.R. reagents without adding to the existing confusion, and without seeking to substitute its private trade

mark for the accepted letters "A.R." As the first step in the achievement of this object the General Chemical and Pharmaceutical Co., Ltd., decided to raise its own standards of purity to such a point that it was able to guarantee that each Judex analytical reagent A.R. *at least* conformed to *any* generally recognised British analytical reagent specification.

While this step provided an entirely satisfactory solution of the problem as far as sales in this country were concerned, it was found necessary, in view of the company's rapidly increasing export trade, particularly to the Continent and to countries where Continental and United States manufacturers held a predominant position in the market, to carry the improvements in specifications one stage further. A consideration of available specifications for analytical reagents showed very forcibly the variation which existed in the amounts of impurity permitted by different specifications covering the same reagents. As a further, and at present the latest, step in improving the standards of British analytical reagents, the company recently adopted the policy of ensuring that, in every case where possible, a given Judex analytical reagent A.R. shall *at least* conform to the *most* stringent tests which are available among the various specifications for a given analytical reagent, both Continental and United States specifications being consulted for this purpose.

It will be appreciated that two very important results accrue from this policy. Firstly, that the Judex analytical reagents A.R. now produced (when considered over a range of tests or over a range of products) provide a series of analytical reagents which are of higher purity than is called for by any individual series of published specifications. Secondly, that, as and when fresh research and improved laboratory practice indicates the means to obtain a purer product and the need for it, the policy adopted admits of the almost immediate incorporation of such improvements in the Judex analytical reagents, A.R.

The foregoing account gives an example, by no means isolated in the history of chemical industry and practice, of the benefits which have accrued to manufacturers and users alike from realising the existence of a difficulty and seeking to solve it on reasoned lines.

Thermochemical Standards

THE Standing Commission for Thermochemistry has adopted the principle that bomb calorimeters must be calibrated by means of some standard substance in order to avoid a lack of homogeneity in the results obtained, in different laboratories, from measurements of the heats of combustion of pure substances and fuels. The commission has adopted benzoic acid as the standard substance to be used in connection with the determination of the heats of combustion of all solid and liquid substances containing the elements G, H, O, and N. As the result of an international agreement, the value accepted for the isothermal heat of combustion, at a temperature of 200° C. per gram of benzoic acid weighed *in vacuo*, is 6319.0 cal.₁₅.

Benzoic acid of a high degree of purity is now prepared in the laboratories of the British Drug Houses, Ltd., for use as a thermochemical standard. It is supplied in sealed tubes each containing approximately 20 grams. Each batch of the acid is tested thermochemically and the heat of combustion is guaranteed to be identical with that accepted by international agreement. The moisture content of the acid does not exceed 0.001 per cent.

Specific Organic Reagents

A NOTABLE feature of recent progress in analytical chemistry is the introduction of a number of new specific organic reagents. Many of these form complexes or co-ordination compounds with metal, affording a ready means of separation and determination by gravimetric or volumetric methods. 8-Hydroxyquinoline is perhaps the most remarkable and at the same time one of the most useful. It has found wide application in the determination of aluminium in particular,

but has been successfully applied to the determination of a large number of other metals. Other reagents such as aluminon and magneson form intensely coloured lakes with the oxides of certain metals and have given rise to excellent colorimetric methods. Diphenyl-thiocarbazone is a reagent of unusual type. With lead it forms a brightly coloured compound soluble in chloroform and carbon tetrachloride and may be used to detect this metal in concentrations as low as one part in twenty millions. Its main use is, however, as a specific reagent for the isolation of lead as a preliminary to its determination by standard methods.

Hopkin and Williams, Ltd., have selected twenty-six reagents of proved reliability for treatment in "Organic Reagents for Metals" and have, since the publication of the second edition of this volume, issued two further reagents, phenylarsonic acid (for tin) and 5:7-dibromo-8-hydroxyquinoline (for copper), with literature abstracts. This class of reagent fills a very important rôle in modern analytical technique and the manufacturers' literature on the subject is of the utmost utility in the laboratory, the use of these reagents not yet having received full treatment in the standard text books.

Reagents for Use in "Spot" Tests

THE methods of micro-analysis involving the use of various organic reagents continue to find wide application in chemical and biological research and in the control of various industrial processes. The working details of these important methods are presented in the "B.D.H. Book of Reagents for 'Spot' Tests and Delicate Analysis," which is now in its fourth edition. The uses of sixty-seven organic reagents are described, and a large number of references to original literature have been included, thus facilitating the application of these reagents to particular problems. The list of reagents available has recently been augmented by the inclusion of chromotropic acid for the detection of titanium, *p*-dimethylamino-benzene-azophenyl-arsonic acid for the detection of zirconium, a:':dipyridyl for the detection of iron, *a*-furildioxime for the detection of nickel, hexanitro-diphenylamine for the detection of potassium, *p*-nitrobenzene-azo-chromotropic acid (chromotrope 2B) for the detection of boric acid and phenyl-trimethyl ammonium iodide for the detection of cadmium.

The B.D.H. "Spot" test outfit supplied by The British Drug Houses, Ltd., provides chemists with a handy collection of 27 reagents and the accessories required for their use. This outfit is of particular value to all who are engaged in colleges and schools, and desire to demonstrate the technique of this relatively new branch of analytical chemistry.

Outfit for Special Analytical Work

CONSIDERABLE interest has been aroused by the recent introduction of the B.D.H. Lovibond Nessleriser, the B.D.H. Lovibond Limitester and the B.D.H. barium sulphate soil testing outfit.

The B.D.H. Nessleriser has been designed with the object of enabling various colorimetric determinations to be made in Nessler glasses, but conducted without the necessity of preparing large numbers of standard solutions for the purpose of comparison. The standards consist of Lovibond permanent colour glasses which have been matched with the colours produced by various reagents when added to solutions containing known amounts of the substance to be determined. The glasses are mounted in discs which are quickly interchangeable. The apparatus can be used for a large variety of colorimetric analyses, including the determination of ammonia, chlorine, iron, nitrites, phosphates, silica and the *pH* of water. Separate pamphlets describing the application of the Nessleriser in various tests are supplied.

The B.D.H. Lovibond Limitester consists of a small bakelite comparator containing a standard Lovibond glass, or a combination of two or three glasses, and a space for a test tube. It is intended for use in limit tests in which a specified

depth of colour must not be exceeded. By the use of one or more of the standard glasses it is possible to adopt the limit-tester for use in any limit test in which depth of colour is the deciding factor. The apparatus is particularly convenient for carrying out the phosphatase test for the detection of raw milk or insufficiently-heated milk in pasteurised milk by the method recently devised by Kay and Graham.

The B.D.H. barium sulphate soil testing outfit is an improvement upon the outfits in which an indicator is simply mixed with a sample of soil and drained off from the mixture. In the new outfit an aqueous extract of the soil is clarified by means of a highly purified barium sulphate prepared by precipitation under special conditions. The clarification is effected in a tall test tube and the pH of the supernatant liquid is determined by means of the B.D.H. soil indicator. A colour chart is provided for showing the various colours produced by the indicator between pH 4.0 and pH 8.0 in steps of 0.5 of a pH division.

Tested Analytical Reagents

IT is now widely recognised that modern scientific requirements demand that only the purest and most reliable reagents should be employed in analytical and research work. It is also of great importance that the analyst should definitely know the maximum amounts of impurities which the reagent is liable to contain. To meet these requirements J. W. Towers and Co., Ltd., of Widnes, placed on the market some time ago a range of over 200 analytical reagents of specified purity. Each bottle is labelled with the maximum limits of impurities; no time is therefore wasted in reference to a handbook. To avoid all risks of contamination by dust, moisture, cork fragments, etc., during storage and use, each batch of chemical, after being most carefully tested, is packed at the works into special amber glass bottles fitted with non-metallic screw caps. Towers Tested Analytical Reagents were the first chemicals to be marketed in this country in this type of package. As the caps fit outside the neck of the bottle it is entirely dustproof, and will be found exceedingly convenient in use.

Phenolic Chemicals for Syntheses

MUCH investigational work is being carried out by Monsanto Chemicals, Ltd., with regard to the applications of phenol in industry. In the synthetic resin industry the reactions of the higher phenols and modified phenols are compared with those of phenol itself (carbolic acid): for accurate work it is essential to be assured that the carbolic acid used is of the highest purity. Monsanto phenol is obtainable in bulk quantities with a melting point of 40.8°C ., whilst absolutely pure phenol has a melting point of 41.00°C . In bacteriological tests pure phenol is taken as the standard, and for this purpose Monsanto phenol is unsurpassed.

Monsanto Chemicals, Ltd., also offer the three isomeric cresols in pure form (ortho, meta and para), and special attention may be drawn to ortho cresol, suitable for cineol determinations. Monsanto ortho cresol has a melting point of 30.8°C ., representing material of well over 99 per cent. purity. The meta and para cresol offered by this firm are of corresponding high purity, and are very well suited for research workers who need reliable chemicals for their syntheses. For investigators who require cresylic acid mixtures to a given composition, Monsanto offer cresylic acid to guaranteed specification.

Water Testing Reagents

APPARATUS and reagents for use in water analysis are a speciality of Sofnol, Ltd. All the solutions required for this branch of analytical chemistry are made and standardised in the firm's laboratory. In addition to the usual indicators used in volumetric work, the now well-known Sofnol Red and Sofnol Purple indicators, specially suitable for general and research work on water are manufactured by them. Their special indicators, together with those of the sulphon-

phthalein series, also made by the firm, are particularly adapted for use in the delicate volumetric work involved in the analysis of waters.

Sofnolite, an analytical absorbent for carbon dioxide, is still made and sold in increasing quantities. This material, which takes the place of caustic potash, and being in solid form has none of the disadvantages of a liquid absorbent, is specially prepared and adjusted for the accurate determination of carbon in steel and fuel analysis, as well as the estimation of CO_2 and other acid gases in general analytical work. A catalyse is incorporated in the absorbing material, which, by change of colour, very clearly indicates the progress of absorption and gives ample warning when the absorbent is nearing exhaustion.

Complete Range of Filter Papers

FILTERING papers have been made by Evans, Adlard and Co., Ltd., for over half a century; this firm is therefore one of the original manufacturers in this country. Since the war the demand for "Postlip" filterings have increased enormously owing to the variety of qualities made, to the purity of the paper (as evinced by the low ash contents), the rapidity of filtration, and by ability to retain fine precipitates. The National Physical Laboratory have put these papers to a very high test and their report proves them to compare favourably with anything in the market. Samples are gladly submitted for testing purposes, both for laboratory and commercial uses.

Hand-made Papers

IT is impracticable to combine in any one grade all the qualities which constitute the ideal filter paper, *i.e.*, rapidity, retentiveness to fine precipitates, wet strength, and freedom from ash, state H. Reeve Angel and Co., Ltd., who are sole sales representatives for W. and R. Balston, Ltd., of Maidstone. Whatman grades are therefore designed to cover all requirements, ranging from cheaper papers for schools (No. 1, 2, 4, etc.) right through to those for the most delicate essay work (No. 42 and 44). Special attention is drawn to latest Whatman developments which are No. 531 (with rapidity and ash similar to No. 31, but hardened so that it will stand up to the most severe washing) and No. 541 (also hardened and therefore extremely strong when wet, and, as an additional advantage, contains only 0.006 per cent. ash, which is so low as to be negligible in circles of 12.5 cm. size or smaller). These two grades mark such an advance in quality that they are likely to supplant non-hardened acid-washed papers for many purposes. No. 531 and 541 are only intended for coarse or gelatinous precipitates, but the manufacture of more retentive hardened papers is being undertaken.

Machine-made Papers

MACHINE-MADE filter papers as made by H. Allnut and Son, Ltd., of Maidstone, are stocked in no less than 24 qualities, including plain whites in different thicknesses. These grades are used chiefly for educational purposes. Crepe whites in thinner substances are used in connection with the filtration of liquids containing oil and metal sludges. Crepe white, greys and creams are suitable for the beer and wine trades. The very thick grades plain and crepe are used in the soap, confectionery and oil trades. A speciality of Allnut's is cream crepe filter paper for use in oil filter presses. One sheet of paper is placed over the normal filter cloth and stripped off when "clogged." This method, of course, simplifies the cloth cleaning process and therefore lengthens the life of the cloth considerably.

Most of the filter papers made by H. Allnut and Son, Ltd., are composed of pure cotton fibre, except in cases where rapid, rather than efficient, filtration is required; for this kind of work a small percentage of chemical wood-pulp is incorporated. All raw materials used in the manufacture of white and cream filter paper are thoroughly bleached to ensure that no colouring material can be extracted by solutions during filtration.

Flotation as Applied to the Chemical Industry

Problems for the Chemical Engineer

CONCENTRATION by flotation is an art whereby a mixture of diverse solids, a metalliferous ore, for instance, can be treated so that it may be divided into its component parts, the more valuable of which are collected as a concentrate of relatively small amount, while the remainder is discarded as a tailing. To effect this separation the material is crushed to a suitable degree of fineness and mixed with sufficient water to form a freely flowing pulp to which small proportions of selected reagents are added, and the whole is agitated and aerated. This produces an emulsion of air in the pulp which leads to a flocculation of air bubbles with certain of the minerals, and this, rising to the surface of the pulp, forms a froth or concentrate, while the portion of the ore which does not float, usually of comparatively low value, is termed the tailings.

This flotation treatment, according to a joint paper by Mr. W. Cullen, I.I.D., and Mr. H. Lavers, M.Inst.M.M., read at a meeting of the Institution of Chemical Engineers, held in London on January 15, is applied most extensively in the concentration of metalliferous minerals, sulphide and oxidised. A wide and useful field is found, also, in the cleaning of coal whereby the ash forming constituents can be eliminated to a considerable extent. Other applications are seen in the concentration of a variety of materials such as sulphur, graphite, apatite, barytes, limestone, etc., all of which can be floated so as to free them from siliceous impurities, etc.

Classification of Minerals

The difference in behaviour of the various minerals, when exposed to air and water, is a means whereby minerals may be divided into two classes: (a) Those which resist wetting and therefore have a tendency when immersed to retain an air film or bubble, such as the metals and their sulphides; and (b) those which are readily wetted by water and resist its displacement by air, such as quartz and gangue minerals generally. This classification is the basis governing treatment by flotation, and it is the aim of the metallurgist to control the operating conditions of the process, for example, by the use of particular reagents, so as to accentuate the differences in behaviour between the minerals in order to bring about their effective separation from one another.

The process of flotation, said the authors, depends on the behaviour of the several minerals in the presence of air and water, and the great variations in this respect are due without doubt to the chemical composition of each mineral and its molecular structure which impart surface energies varying according to the particular mineral.

Despite the knowledge that metals and mineral sulphides had a tendency to float, which was increased by their affinity for oils, etc., no effort was made to evolve a practical method of concentration by this means until near the beginning of the present century. At that time experiments were made and a few small plants were erected in which various methods were tried which led, eventually, to the present system of flotation concentration.

Of the more noteworthy of the early methods of concentration by means of oil and/or acid the bulk oil process used a large proportion of a viscous oil which, added to a pulp of water and crushed ore, collected the sulphide minerals, and by reason of its lighter density supported the minerals on the surface of the mixture. A modification of the process was the addition to the mixture of a small pro-



Dr. William Cullen.

portion of an acid which aided the selectivity of the oil for the minerals. The difficulty of separating the oil from the mineral and the consequent high losses of oil were factors which caused this process to be discontinued.

The introduction of the acid circuit flotation process by Potter was an event of great significance, as it showed that flotation could be brought about without the addition of oil. A warm acidulated circuit was used, with sulphuric acid as the sole reagent. Carbon dioxide was evolved from the carbonates of the ore, and this gas became attached to the sulphides, raising them to the surface of the liquid. The expense of heating the pulp to a temperature of about 80° C. and the corrosive nature of the acid liquor are features which detracted from the value of this process, and, although several hundred thousand tons of Broken Hill tailings have been treated by this means for the recovery of zinc blende, it has been displaced by the method of froth flotation.

Cattermole Process of Granulation

The Cattermole process of granulation did not aim at the flotation of the minerals, but it was really the forerunner of froth flotation, and is thus worthy of mention. In this process both acid and oil were used in a warm circuit, and the sulphides were gathered into firm granules or aggregates by the oil, and these, being of high density, were separated from the gangue minerals by simple classification. While showing economy over the bulk oil treatment, since the oil used was only 2 to 3 per cent. of the weight of the ore, compared with 100 per cent. in the earlier process, it was apparent still that the weight of oil must be further reduced. Experiments showed that the granules became less firm as the amount of oil was decreased and a point was reached where the granule became flocculent. On increasing the agitation these soft granules, instead of becoming denser, tended to coalesce with the air bubbles which were beaten into the pulp by the more rapid agitation, and, when the pulp was led into a flotation spitz, the floccules were seen to float readily as a froth on the surface of the liquid. In this way froth flotation was discovered, and it quickly became the chief, and later, the only commercial process.

In the film flotation process the concentrate passes, as a layer one particle in thickness, over the surface of the water, with each particle of the mineral lying in a depression in the surface and in contact with the adjacent air. If we consider this film as being cut into a number of small pieces, each of which is then formed into a bubble enclosing a small volume of air, we have a crude representation of a flotation concentrate froth consisting of a number of bubbles the enveloping films of which are coated closely with particles of the sulphide mineral. A froth may be several inches deep and consequently has a vastly greater mineral-carrying capacity than a single film covering the same horizontal area.

Addition of Reagents

An ore is prepared for flotation by adding certain reagents to the pulp in the ball mill or to the flotation machine or perhaps at both points. Such reagents may be classified as (1) collectors or selectors, (2) frothing agents, (3) gangue modifying agents, or (4) depressant and activating agents.

The chief property of a collector is a selective affinity for the metalliferous mineral in preference to the gangue. It may be an insoluble, or partly soluble, oil which is adsorbed at the sulphide surfaces, imparting to them an increased water repellent character which will enhance their flotation in preference to that of the gangue. In recent years the oil has been replaced almost entirely as a collector, and its place taken by certain sulphur derivatives of organic composition in which the sulphur is loosely combined by an unsaturated bond. The best known of these collectors are the xanthates of the alkaline metals. These react with the ore in the flotation circuit, and apparently yield sulphur radicles to the sulphide minerals, which become more strongly averse to wetting and are thus in a good condition for flocculation. Other widely used collectors are the aerofoams which are produced by the action of cresylic acid on phosphorus pentasulphide. Thiocarbonilide, hexylamine and reaction products derived from the xanthates are used also in some mills.

Many sulphide ores, when newly mined, contain small quantities of free sulphur which may be extracted by lixiviation with ether: also certain minerals, such as the pyritic compounds of iron and particularly certain pyrrhotites, yield sulphur while being crushed finely, and apparently such free sulphur is beneficial in flotation as a collector. It may be possible that the sulphur radicles derived from the xanthates function in a similar manner. The collectors are selective in character as regards the distinction between sulphide and gangue minerals, but they have in most instances no power of discrimination when used in the differential separation of the various sulphides. Recent work, however, indicates that certain collectors, notably the xanthates of the higher alcohols, cetyl, etc., may promote the flotation of one sulphide in preference to another.

Frothing Agents

The frothing agents are bodies which are usually soluble in water to the extent required in flotation and they function by providing a more or less stable film or envelope for the air bubble. Pure water when agitated and aerated cannot form a froth as it has no means of creating an envelope for the air bubbles and if an air emulsion is formed it is of a most evanescent nature. When a frothing agent is added to the water the effect of the agitation is to throw out parts of this agent at all the free surfaces of the water, thus providing protecting films for the air bubbles. Such a froth is more or less of a temporary nature, but the presence of sulphide minerals in the water adds to the stability of the films.

The amount of frothing agent required for efficient flotation may be less than one-tenth of a pound per ton of ore, and it is seldom that more than a half-pound per ton of ore is used. This frothing agent may be a slightly soluble oil such as oleic acid, an essential oil, a coal tar fraction or one or more of a large number of organic compounds

such as alcohols, esters, etc. Those in general use are the essential oils, pine oil, and eucalyptus, and coal tar fractions, such as creosote and cresylic acid. Certain inorganic salts, such as the soluble chlorides, carbonates, phosphates, etc., are available as frothing agents but are seldom used for this purpose.

A single reagent may serve both as collector and froth producer and this is particularly so with the essential oils. Oleic acid also is serviceable in both capacities and was used at Broken Hill in the treatment of thousands of tons of tailings containing zinc blende, when a warm circuit was maintained in the mill and sulphuric acid was used as a modifying agent. Amyl alcohol is another reagent which will serve both as collector and frothing agent and, although it is much more soluble in water than is required in flotation, it is readily thrown out of solution when the pulp is agitated, and produces films at the air/water surfaces which prevent the coalescence of the small bubbles into large ones. It is, however, the general practice now to use the organic sulphur compound as collector with essential oil or coal tar fraction as frothing agent in the presence of an alkaline modifier.

The Use of Alkalies

Alkalies, such as lime and soda ash, have found extensive use in flotation and one or other of these two is used in almost every flotation plant as a gangue modifying agent. The alkaline circuit is favourable to differential separation of the sulphides. While the alkalies are used chiefly as modifying reagents for the gangue, they act in certain cases as depressants of various sulphide minerals. Lime retards the flotation of iron pyrites, pyrrhotite and, to a lesser extent, galena. Soda ash is to be preferred for the treatment of lead ores where no pyrites is present, but if used in strong solutions this reagent also acts as a depressant of several sulphides.

The reagents are adsorbed at the surface of the mineral and may often enter into chemical combination with the metal radical of the mineral; for example, potassium bichromate, when used as a depressing agent for galena, forms lead chromate on the surface of that mineral. On the other hand, the products of the reaction may activate the mineral as is the case when copper salts are used in promoting the flotation of zinc blende, or when the xanthates are added to accelerate the flotation of sulphides in general. In the flotation of oxidised minerals the fatty acids and their soluble soaps react to form films on the minerals of oleates, stearates, etc., which are insoluble in water and avid for air.

Treatment of Lead Zinc Ore

The treatment of lead zinc ore at Broken Hill by the minimum-oil method was described in a recent paper by Mr. T. A. Read, chief metallurgist at the Broken Hill South Mine, where some 1,500 tons of ore are treated daily.

The ore is first treated by gravity for the recovery of about 60 per cent. of the galena which can be collected by jigs and tables in a fairly coarse size. The tailings are then treated by flotation with a final recovery of about 94 per cent. of both lead and zinc in the form of high grade concentrates. Galena is floated with the following reagents:—

Sodium silicate	= 0.034 lb. per ton of ore.
Ethyl xanthate	= 0.039 " " "
Eucalyptus oil	= 0.041 " " "

after which the blende is floated with

Copper sulphate	= 0.766 lb. per ton of ore.
Lime	= 0.335 " " "
Sodium aerofoam	= 0.134 " " "
Eucalyptus oil	= 0.002 " " "

The same circuit is used for both the flotation sections and it is maintained in a very slight alkaline condition by the addition of lime in the zinc section and of the sodium silicate in the lead section. No retarding agent is added in the lead section, but the lime in the zinc section restrains the floating of the small quantity of pyrites which is in the ore.

This work may be compared with that done in the Consolidated Mining and Smelting Co.'s plant at the Sullivan Mine, Canada, where about 6,000 tons of a highly pyritic lead zinc ore are treated daily and lime and sodium cyanide are both used as depressants. Here the reagents are:

In the lead section:—

Soda ash	= 0.8	lb. per ton of ore.
Lime	= 0.2	" "
Sodium cyanide	= 0.06	" "
Water gas tar	= 0.25	" "
Cresylic acid	= 0.13	" "
Sodium zanthate	= 0.15	" "

In the zinc section:—

Lime	= 0.6	lb. per ton of ore.
Copper sulphate	= 0.65	" "
Coal tar creosote	= 0.06	" "
Sodium zanthate	= 0.23	" "

The lime is used chiefly as a depressant of the pyrites during the flotation of the blende. The cyanide in the lead section depresses the blende and, in conjunction with the lime, the pyrites. The tar fractions are used as frothing agents, the xanthate as collector, and the copper sulphate as an activator or accelerator for the flotation of the blende.

Modifying Agents

Of the various modifying agents the two with the greatest individual influence probably are cyanide and copper sulphate. Cyanide has been mentioned as a depressant of pyrites, pyrrhotite and blende, in the latter case removing films of copper which might otherwise promote the flotation of this mineral. It acts also as a cleaning agent and consequently as an accelerator in the flotation of metallic copper. The influence of copper sulphate is limited practically to the acceleration of the flotation of blende, and is the reagent with the most extended use for lead zinc ores. This effect of copper salts on the flotation of blende is so pronounced that in certain patent specifications dealing with the concentration of lead zinc ores it is stipulated that the galena must be floated in an alkaline circuit which is entirely free from copper in any form. The amount of copper sulphate which is added normally in the flotation of blende may be as much as two pounds of the salt per ton of ore, but it has been noticed that as small an amount as two ounces per ton of ore shows improvement in the recovery of zinc.

A precipitate produced within the pulp by, say, the addition of two salts which react with one another, will serve as a promoter of flocculation, and thus become a medium for giving stability to an otherwise scanty and fragile froth, or may be adsorbed at the surfaces of certain sulphides, thus promoting a differential separation. For instance, it is claimed that freshly precipitated sulphide of copper, mercury or lead will collect the gold values in a pulp which has normally no other mineral which can be recovered by flotation.

Adsorption of Iron Sulphide

Freshly precipitated iron sulphide is adsorbed at the surfaces of galena or of iron pyrites, and the flotation of both is improved. Other bodies have been used, such as charcoal or coke, but their influence in promoting flotation is doubtful excepting when they are used in conjunction with sodium cyanide in the treatment of a gold ore when the gold is dissolved and is precipitated on and floated with the charcoal. Finely divided clay or slime may act as a depressant in flotation as it tends to be adsorbed at the free surfaces and so hinders the action of the frothing agents, thus preventing the formation of a stable froth. With an ore which contained a small proportion of inherent slime of a quasi-colloidal nature it was found impossible to float the sulphide-molybdenite, until some $\frac{1}{2}$ per cent. of the finest of the slimes had been removed by classification.

Certain organic compounds, having a colloidal nature, such as starch, tannin, albumen, etc., have a dispersive influence on the mineral particles, and this is used with advantage where the minerals forming the gangue are prone to float. For instance, in treating a lead zinc ore, of which the gangue

was largely a carbonaceous shale, the galena was floated together with a quantity of this shale from which it could be separated in the usual manner only with great difficulty. However, on refloating this concentrate in a circuit to which a small quantity of starch was added, the galena was wholly recovered and the lead in the concentrate improved from about 30 per cent. to 80 per cent. In another case the gangue was largely a hydrous mica which floated very readily, giving a 30 per cent. concentration. The use of starch dispersed the mica, while the sulphide amounting to about 1 per cent. of the ore was floated by the aid of xanthate. Further, the use of starch in the flotation of some coals will facilitate the separation of bright coals from the dull varieties.

Coal, graphite, carbon black, sulphur, etc., can be floated in much the same way as the sulphides, except that the organic collectors are less efficient with these non-metalliferous materials. Coal is cleaned readily from ash-forming material when this is crushed free from the clean coal, but no degree of fineness in the crushing will lower the inherent ash content of the coal separated by flotation. The process is in operation on several collieries in Great Britain with good results, and by its means many thousands of tons of coal are cleaned annually in Germany, Spain, France, etc.

The reagents used generally are coal tar fractions, such as cresol and creosote, while petroleum may, in some instances, be used as a collector. Xanthate has been used in small quantities as a collector, and is found to be beneficial in the subsequent settling and filtering of the clean oil. The cleaning of coal slurry, 10-mesh and under, has not met with the attention it deserves, largely owing to difficulties which have been experienced in handling the cleaned coal. However, as the use of vacuum filters is becoming more general in the washing plants it is probable that flotation will be applied more widely to the separation of the finer portions of the coal which are, at present, largely waste products.

Costs of Flotation Treatment

The costs of flotation treatment vary considerably according to local conditions and particularly with the tonnage of ore treated daily. In the large mills in the United States where ores, containing chalcocite, are treated, the total cost, inclusive of crushing, flotation and disposal of products, may be as low at 2s. 2d. per ton of ore. At Broken Hill, in the South Mine Co.'s mill, the costs, including crushing, two flotation treatments, gravity concentration and disposal of products from 1,200 tons of ore daily, are 5s. 5d. per ton of ore, which is made up as follows:—

	Sh. per ton of ore.
Coarse crushing and conveying	0.293
Gravity lead section (including fine grinding)	2.840
Lead flotation section	1.565
Zinc flotation section	0.781
<hr/>	
	5.479

If the gravity treatment, but not the cost of fine grinding, is eliminated from the above total, the cost would be 4s. approximately.

IN 1934 imports of paste paints into the Philippine Islands amounted to 1,227 metric tons, valued at 317,709 pesos. The United States was the largest supplier, shipping over 70 per cent. of the total. Germany, Great Britain, Japan and China, in the order named, were the other important countries represented in the trade. Great Britain, Japan and China are able to undersell the American products, but more recently Japan and China have supplied paste paints at lower prices than Great Britain, thereby securing a stronger hold on the market for this type of paint. The most important British paste paint which has been on the market for several years is "Dixon's," while prominent green paste paints are the Chinese product "Flower," and the Japanese brand known as "Gallo."

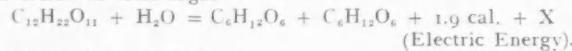
Chemical Action in the Fermentation Cell

Electricity Produced by Bacteriological Action

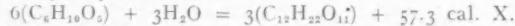
In a recent article in "Zentralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten," the Rev. M. C. Potter, Sc.D., M.A., Emeritus Professor of Botany in the University of Durham, said that on some research work he had done upon the origin of electricity in plants and animals experience shows that the calories latent in cane sugar exceed the calories latent in the alcohol derived from this sugar; and also that decaying organic matter may attain a considerable temperature. It is accepted that part of the available energy liberated during fermentation and decomposition can be expressed as calories, but it has not been recognised that the total decrease of energy must also include coulombs in addition to calories. This total energy must be considered from the aspect of the intensity factor and the capacity factor. The intensity factor, shown by the E.M.F. produced during fermentation and decomposition, was the first to be determined and was definitely established by experiments published as long ago as 1911. The present note is concerned with the capacity factor and experiments are quoted to show how this factor can be determined by means of the electro-deposition of copper.

Chemical Reactions

In 1929 it was suggested that the following equations more nearly represent the chemical reactions involved. The inversion of cane sugar



The hydrolysis of starch



The fermentation of sucrose



In 1931 Cohen confirmed the result that electrical energy was produced during the action of bacteria. His estimate of the current produced is in accordance with that given in 1911. Cohen further states that he obtained an E.M.F. of 37 volts but he gives no details of his experiment.

electrode (E₁) was placed in the porous pot and a similar electrode (E₂) was placed in the solution in the container. The electrodes were connected by a Morse key (K) to a galvanometer (G) and a condenser (C). Any residual charge upon the electrodes was noted. When yeast was added to either the solution in the container or in the porous pot an E.M.F. was set up between the electrodes. This E.M.F. was always found to be proportional to the activity of the yeast and did not occur when conditions were unfavourable to the activity of this micro-organism. The electrode in the yeast-fermentation solution—which may be termed the exciting solution—was always found to be the cathode. Parallel experiments were carried out with pure cultures of certain bacteria and always with the same result. No electrical action could be observed when the cultural conditions were unfavourable to the growth of these bacteria. The second arrangement is shown in Fig. 2. Here the work done by the fermentation can be measured by the electro-deposition of copper. Portions of the same saccharine solution are placed in the container (B) and in the porous pot (A), the electrodes are led to copper wires dipping into a solution of CuSO₄ in a separate vessel (V). When yeast is added to the solution in the container, an electro-deposition of copper is gradually formed upon the copper wire connected to the electrode in the container. This deposition of copper is found to be proportional to the amount of sugar which has undergone fermentation.

Electro-Deposition of Copper

In the third arrangement (Fig. 3) CuSO₄ solution is placed in the porous pot (A) which is then immersed in the yeast-fermenting saccharine solution in the container (B). A non-polarisable electrode (E₂) dipping into the solution in the container is then connected with a copper electrode (E₁) dipping into the CuSO₄ solution in the porous pot. An electro-deposition of copper gradually forms upon the copper electrode in the solution in the porous pot, the amount of the deposition being proportional to the activity of the yeast.

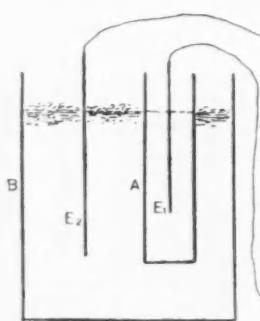


Fig. 1

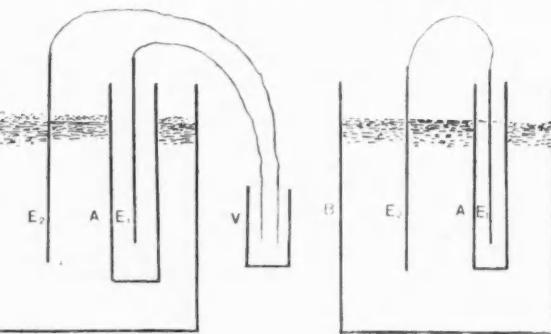


Fig. 2

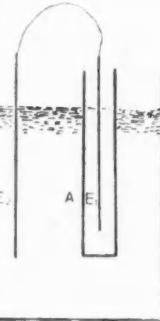


Fig. 3

In the same year, 1931, the author published an account of certain experiments which showed that the electrical energy set free during fermentation and decomposition could be measured by the work done during the electro-deposition of copper. At the same time some experiments were quoted which showed that the electrical energy set free during the decomposition of manure, decaying leaves and lawn mowings could be detected and estimated. In all these instances a definite electro-deposition of copper took place upon the electrode connected to the scene of bacterial action.

The cell may be described under three different aspects. The original arrangement, Fig. 1, consisted of a porous pot (A) or tube of dialysing paper, filled with an aqueous solution of cane sugar or glucose, placed within a container (B) filled with the same saccharine solution. An unattackable

Two of the special features of the fermentation cell which need careful consideration are (a) the cultural solutions, (b) the electrodes. Cane sugar is not fermented by yeast unless certain other substances are present, thus to ensure fermentation taking place it was found convenient to employ Pasteur's solution. Further, since cane sugar does not ionise when dissolved in water, an aqueous solution of this carbohydrate possesses a very high electrical resistance. This high resistance may be lowered by the addition of small quantities of such electrolytes as NaCl, KNO₃, MgSO₄. The addition of these salts enables the solution to conduct an electric current without hindering the process of fermentation. These facts offer an explanation why no electrical effects take place when yeast and cane sugar are brought into contact in an aqueous solution.

Neither cane sugar nor alcohol ionise in aqueous solutions. As a consequence no concentration effects can be traced to the diminution of the sugar and the increase of the alcohol. The concentration of the electrolytes being precisely the same in both the container and in the porous pot, no concentration effects can take place in the fermentation cell. And for this reason it may be emphasised that the electrification in the fermentation cell cannot be due to a concentration effect. After trials, it was found convenient to use the formula

Cane Sugar	...	...	...	684.00	gr.
Ammonium Tartrate	...	...	...	40.	"
Calcium Phosphate	...	...	...	0.80	"
Potassium Phosphate	...	...	...	8.00	"
Magnesium Sulphate	...	...	...	0.80	"
Tap Water to make up to 4,000 c.c.					

This is roughly a 17 per cent. solution of cane sugar with the ingredients of Pasteur's solution. The quantity 684 gr. of sugar, two grammolecules, was adopted to avoid calculations. A small quantity of electrolytes, e.g., NaCl , KNO_3 , MgSO_4 was added to reduce the electrical resistance of this solution. These electrolytes, it was found, did not influence the process of the fermentation. This solution was divided between the container and the porous pot. After the apparatus had been set up the yeast was added to the solution in the container and the fermentation allowed to proceed. The weight of copper electrically deposited from the fermentation of one gram-molecule of sugar could be determined. The first experiments showed that the nature of the electrodes was a matter of importance when dealing either with a fermentation cell or with a metallic-acid cell. A great contrast was noted in the behaviour of these cells when metallic electrodes or non-polarisable electrodes were used. With platinum electrodes in the exciting solution, the condenser and galvanometer could be used to measure the E.M.F. of either the fermentation cell or the metal-acid cell. Such electrodes were not suitable to measure the current generated in the cell.

Use of Carbon Rods

On the other hand non-polarisable electrodes in the exciting solution gave no response with condenser and galvanometer but could be used when attempts were made to measure the current passing through these cells. When non-polarisable electrodes are employed in the exciting solution a current flows through the cell and it is possible to measure the electrical energy of the fermentation cell by the electro-deposition of copper. Carbon rods have been found suitable for these experiments. The carbon rod, after thorough cleansing, had one end tightly bound with copper wire. This juncture could be protected with insulating tape to avoid any error which might arise from damp or other atmospheric conditions. Similar electrodes could be immersed in the solution in the container and in the porous pot after the manner described in Fig. 2. The plan whereby the wires dipping into the CuSO_4 solution were suspended from the electrode connection, was adopted to facilitate the inspection of these wires without at the same time disturbing the efficiency of the experiment. Carbon electrodes (13 x 4 cm.) as used in a Leclanche' cell have been found to be quite efficient. These carbon plates have the advantage that the wires can be secured to them by means of binding screws so that the circuits can be readily made. As a rule the junction of the carbon electrode and the wire attached to it would be above the surface of the solution in which it was immersed.

Estimating the Electricity

When carbon electrodes from the fermenting and non-fermenting liquids (Fig. 2) were connected to copper wires dipping into a solution of CuSO_4 in the vessel (V), an electro-deposition of copper gradually formed upon the wire connected to the electrode in the fermenting liquid. This wire always functioned as the cathode, the amount of copper deposited being determined by the activity of the fermentation. In the early experiments no attempt was made to estimate quantitatively the amount of electricity produced during the fermentation of a given quantity of sugar. The

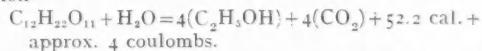
E.M.F. between the fermenting and non-fermenting liquids was all that was obtained. Latterly it has been sought to estimate the quantity of electricity in coulombs which accompanies the fermentation of one gram-molecule of cane sugar by the weight of copper deposited during the process of yeast fermentation of this quantity of sugar.

One coulomb deposits electrically 66 mg. of copper. Repeated experiments showed that no copper was deposited when metallic electrodes were used. When Leclanche' carbons were employed in both the fermenting and non-fermenting liquids, the electro-deposition of copper upon the cathode was quite evident. The average amount of copper deposited during three experiments was 0.85 mg. per g. mol. of cane sugar. This represents 1.28 coulombs per g. mol. of cane sugar. It should be mentioned that no attempts were made to maintain the apparatus at a temperature suitable for the fermentation to proceed in an active manner. These numbers, therefore, would appear to be far too low.

Experiments with Leclanche Carbon

An additional series of experiments was designed. In this series a Leclanche carbon was used as the electrode in the fermenting solution, in conjunction with a Leclanche' porous pot complete with the carbon electrode packed round with carbon and MnO_2 . This arrangement is the ordinary Leclanche' cell in which the zinc electrode is replaced by a carbon electrode, and a sugar-fermenting solution is substituted for the ammonium chloride solution. This apparatus was supported above a paraffin lamp, so that the temperature of the apparatus could be maintained at approximately 30° C. The average of four of these experiments gave 5.1 mg. copper deposited per gr. molecule of cane sugar. This represents 3.86 coulombs per gr. molecule of fermenting sugar.

It is estimated that approximately 8 coulombs are set free during the yeast fermentation of one gram-molecule of cane sugar and hence this reaction might be represented by the equation



The E.M.F. of a fermentation cell depends upon the chemical reactions taking place in the exciting liquid and is developed whether the circuit is open or closed. The liberation of electricity is independent of the pH of the media, provided that the conditions are such that the activity of the micro-organisms is not hindered.

Aslib Book List

A Guide for Users of Technical Information

THE Association of Special Libraries and Information Bureaux has commenced the publication of a quarterly "Aslib Book List," at a yearly subscription rate (to non-members) of 10s. 6d. The main object of this quarterly list is to provide public and other libraries with a selected list of recent scientific and technical books. The selection has been made by those with special knowledge of the individual scientific and technical subjects. It is not claimed that the list is exhaustive and it is hoped that the range of subjects will gradually be extended. Only books in the English language and, with a few exceptions, those published within the previous six months have been included. The limitation with regard to date, however, has been somewhat extended in the case of books published abroad or those on very specialised subjects. No attempt has been made to introduce detailed classification of the volumes. The books are assembled for convenience under broad main headings and are further sub-divided into (a) books suitable for general readers, or books treating the subject in an introductory, elementary, or general manner; (b) books of an intermediate degree of technicality, or suitable as text books for students; (c) books of an advanced or specially technical character; and (d) directories, dictionaries, handbooks, lists and catalogues, encyclopaedias, year books, and similar publications.

Advances in Chemical Industries

How and When Plant Becomes Obsolete

THE primary necessities of life—food, clothing and shelter—have been almost revolutionised by advances made in the chemical industries—or, at any rate, by the application of science in general and chemistry in particular to industry, and chemistry is playing an important part in providing us with the luxuries of life, our transport and our recreation, said Mr. L. A. Munro, of Imperial Chemical Industries, Ltd., in an address on "Chemical Industries" to the Chartered Institute of Secretaries, in London, on January 14. Dealing with the growth of chemical process industries in recent years, Mr. Munro said that in the case of iron and steel the gross output in 1930 was practically the same in value as in 1907, whereas the value of the gross output of chemicals was $2\frac{1}{4}$ times as high in 1930 as in 1907. Shipbuilding increased over the period by about 30 per cent., while soap making increased $2\frac{1}{2}$ times. Mining and quarrying increased by 24 per cent., while paper making increased more than 200 per cent. The production of textiles as a whole increased by some 30 per cent., whereas the output of artificial silk and silk increased nearly five-fold.

Prosperity of Process Industries

The process industries, like glass, paper and artificial silk, had prospered since 1924 more than the heavier industries, like quarrying, iron and steel, and coal mining. Glass production in 1934 was nearly 40 per cent. higher than in 1924, paper production some 60 per cent. higher, rayon production 270 per cent. higher; while, on the other hand, the quantity of coal raised was 18 per cent. less than in 1924, production of pig iron 18 per cent. lower, and shipbuilding—ships under construction—nearly 60 per cent. down.

The process industries withstood the recent slump much better than the heavy industries. The minimum reached in pig iron produced was 49 per cent. (1932); for coal raised the figure was 77 per cent. (1933), and the shipbuilding minimum of 20 per cent. of the 1924 figure was reached in 1932. In the case of glass, on the other hand, the minimum was 99 per cent., that for paper 115 per cent., and for artificial silk 193 per cent. of the 1924 figures. The non-ferrous metal trade reached a minimum of 96 per cent. of the 1924 activity in 1932, and in 1934 was nearly 50 per cent. in excess of 1924.

Competition had increased in recent years, not only within the industry but from without. This was one of the important aspects of rationalisation. The great gas undertakings, distilleries, soap factories, and even motor car manufacturers, of the world were in many cases important manufacturers of chemicals.

By-Products of Other Trades

To the motor car manufacturer who made glass, for example, any glass beyond day-to-day requirements turned out by his plant running at economic capacity became a by-product. Such by-products were a very serious factor with which the chemical industry proper had to compete. The chemical manufacturer had to cater for the requirements of users of all kinds of chemical products, and could not, for the most part, pick and choose. The cream of his trade tended to become less remunerative. Although most of the products of the chemical industry were producers' goods, and being in this category were sheltered to some extent from changes in the character of demand for consumers' goods and from changes in fashion, their production could only be increased in relation to this demand. The nature of the demand for chemicals for manufacturing artificial silk or paper could be profoundly changed almost overnight by the discovery of new processes for the manufacture of artificial silk or paper, or by changes which resulted in one process

obtaining economic ascendancy. The products of synthetic industries were less firmly established than the natural ones with which they competed.

The manufacturer of a product must keep in sufficiently close touch with the final consumer to be able to sense changing trends and tendencies likely to affect the consumption of his product. The introduction of entirely new products or product groups with new properties was the legitimate field of expansion for the progressive manufacturer. The standard of living could only be made to accelerate by increasing the rate at which new consumption was brought about, thus giving rise to new production.

Competition and Over-Production

There was an important connection between inter-commodity competition and so-called over-production. The stimulus given to beet sugar production during the war created a situation in the sugar industry which had been very difficult to cope with. Another interesting example was provided by the whaling industry in recent years. Mr. Munro's impression was that the buying pool contracted for approximately the whole of the 1929-30 and 1930-31 catches at a fixed price. The result was that the 1930-31 catch was very much higher than the 1929 catch. The overwhelming supply of whale oil, he understood, brought about the substitution of this oil for soap making, in place of other oils, with the result that the markets for competing oils slumped to an unprecedented degree.

The recovery of scrap rubber was a factor which must be taken into consideration by the plantation rubber industry, just in the same way that the growth in heavy motor transport was a factor of prime importance to the railways. All these competitive activities might be desirable, but they gave rise to economic disturbances, owing to the present incomplete stage of rationalisation. The recovery of scrap iron had reduced the rate of increase of iron ore mining, and, while the steel industry might have benefited, anyone interested only in iron ore mining could not have viewed the situation with equanimity. Provision for depreciation and obsolescence assumed a new aspect.

Comparatively new plant might become obsolete if the market for its product disappeared. In modern industry the "point of maximum return" was high—*i.e.*, plants were of necessity large and expensive, yet the economic life of the product was short. "Profits" must be appreciable, therefore, to cover high rates of obsolescence. It was the "out of date," not necessarily the "old," plant which became obsolete.

Letting the Imagination Rip

In these days, when plastic materials for the manufacture of an infinite variety of household articles were made by combining two disinfectants—carbolic acid and formalin—or by synthesising a natural product like urea and combining that with formalin; when motor car parts were about to be made on a large scale from soya beans; when transparent paper, paint and nail polish were made from Canadian and Scandinavian forests; when vinegar was made from calcium carbide; and anti-knock materials for doping petrol, from sea water; one was tempted to let one's imagination rip. When carbon dioxide gas, the same gas as was exhaled by animal life, was used, not only for refrigeration but for the preservation of fresh food, and the rare gases of the atmosphere, which were laboratory specimens a few years ago, and rare metals, only recently discovered, were used for the manufacture of electric lamps, gas mantles and radio valves; when varnishes and explosives were made from soap lye, and toilet soap from whales, how could we begin to put any limit to what would be done?

Hydrogen Production by the Badische Process—IX.

Preheaters, Scrubbers and Lime Boxes

In continuation of notes on the Economics of the Synthetic Manufacture of Ammonia, published in "The Chemical Age," October 5 to November 16 inclusive, the present series deal particularly with the design of the plant for the production of hydrogen by the Badische Process.

In order to start the converters it will be necessary to install preheating capacity to raise the gas and steam for two converters at a time up to 240° C.

Volume of gas = 775×2 cu. ft. per minute at 20° C. and normal pressure.

Amount of steam = 36.4×2 lb. per minute.

Volume of Nitrogen = 69.5×2 cu. ft. per minute, at 20° C. and n.p.

$$\begin{aligned} \text{Therefore, Heat required} &= 1,550 \times 0.0251 \times 0.84 \times 220 \\ &+ 72.8 \times 0.47 \times 138 \\ &+ 139.0 \times \frac{28}{385} \times 0.244 \times 220 \\ &= 7,200 + 4,720 + 540 \\ &= 12,460 \text{ C.H.U. per minute.} \end{aligned}$$

Allowing a maximum velocity of 100 ft. per second in the tubes (6,000 ft. per minute), cross section of tubes =

$$\begin{aligned} \frac{1,550 \times 513}{293} + \frac{72.8 \times 385}{18} \times \frac{513}{293} + 139 \times \frac{513}{293} \\ = \frac{2,710 + 2,710}{6,000} + 244 \\ = \frac{5,604}{6,000} = 0.945 \text{ sq. ft.} \end{aligned}$$

If 5 inch tubes are used with area 0.136 sq. ft., number of tubes required would be 7.

Number of groups of 3 tubes (say) 3.

Heat to be transferred = $12,460 \times 60 = 747,600$ C.H.U. per hour. Assuming combustion gas enters at 900° C. and leaves at 300° C., the temperature gradient at one end will be $900 - 240 = 660$ ° C., and at the other end $300 - 20 = 280$ ° C. The mean temperature gradient is therefore

$$\frac{660 - 280}{2.3 \log \frac{660}{280}} = \frac{380}{.86} = 442^{\circ} \text{ C.}$$

Let the transmission be 4 C.H.U./sq. ft./° C./hour. Then

$$\frac{747,600}{442 \times 4} = 423 \text{ sq. ft.}$$

of heating surface is required.

The heating surface of one tube being 23.35 sq. ft.

$$\text{Number of tubes} = \frac{423}{23.35} = 18.$$

As it has already been arranged for nine tubes in parallel to pass the gas, therefore, if two tubes were placed in series, the necessary heating surface would be obtained. It is probable it would be best to instal two units, one for each group of five converters, each consisting of two groups of three tubes, each of which would consist of two 5 inch pipes, similar to those used in the Grillo preheaters.

The gas leaving the system would have a composition as follows:—

cu. ft.	cu. ft.
H 9,648,650 at 20° C.	= 8,520 per min. at 100° C. 38.9%
CO ₂ 528,350 "	= 468 " " " 2.4%
N ₂ 3,102,100 "	= 2,750 " " " 12.5%
A ₂ 21,500 "	= 15 " " " 0.2%
H ₂ O 541,000 lb.	= 10,200 " " " 46.2%

$$(541,000 \text{ lb. H}_2\text{O}) \times \frac{541,000}{18} \times \frac{385}{293} = 21,953 \text{ "}$$

$$\frac{21,953}{1,440} = (\text{about}) 10,200 \text{ cu. ft. per min.}$$

The volume from each catalyser would therefore be .2,194 cu. ft. per minute, and the main carrying the gas to the scrubber would be

(53)

$$\sqrt{\frac{21,983}{60 \times 60 \times 0.786}} = \sqrt{7.75 \text{ ft.}} = 2.8 \text{ ft.} = 33 \text{ inches.}$$

(The volume will be slightly less as the pressure will not have been reduced by the resistance of the catalyst, etc., by a full 2 lb.) The partial pressure of the steam would be about 6.8 lb. (i.e., 14.7×0.462). Steam condenses at 80° C. at this pressure.

The volume of uncondensable gas is 9,230 cu. ft. per minute at 20° C. (specific heat 0.715 and density = 0.0251 lb. per cu. ft.).

The mass of steam is 376 lb. per minute.

Therefore heat to remove from gas in cooling from 100° to 50° C. = $9,230 \times 0.715 \times 0.0251 \times 50 = 8,270$

Heat to remove from water vapour in cooling

from 100° to 80° C. = $376 \times 0.47 \times 20 = 3,530$

Heat to remove in condensation = $376 \times 550 = 206,000$

Heat to remove in water in cooling from 80° to 50° = $376 \times 30 \times 1 = 11,300$

C.H.U. per min. 220,100

Mean temperature of gas in scrubber 75° C.

Volume of uncondensable gas = $9,230 \times \frac{348}{293} = 11,000$ cu. ft. per min.

So that with a mean velocity of 15 ft. per second

$$\frac{11,000}{900} = 12.2 \text{ sq. ft.} = \text{net area through scrubbers.}$$

Therefore, gross area if filled with 3 inch pottery rings

$$\frac{12.2 \times 100}{40} = 30.5 \text{ sq. ft.}$$

If the scrubbers are 6 ft. in diameter = 28.2 sq. ft. area.

Number of scrubbers required = 1.08, and wetted surface = 19,700 sq. ft.

Quantity of cooling water required entering at 15° C. and leaving at 45° C. =

$$\frac{229,100}{30 \times 1} = 7,620 \text{ lb. per minute.}$$

$$= 762 \text{ gal. per minute.}$$

$$= 45,700 \text{ gal. per hour.}$$

This quantity of water could be dealt with in two scrubbers, through each of which 380 gal. per minute would be pumped; this would afford ample scrubbing and cooling capacity for the gas. The water used for this purpose should be circulated, so that it is nearly saturated with hydrogen, carbon dioxide, etc., and does not contain oxygen, which might contaminate the gas at this stage; if this is the case the quantity of CO₂ and H₂ removed by this scrubbing may be neglected. If fresh water is used, on the other hand, the removal of CO₂ would be about

$$(0.04 \times 1 \times 0.878) \times \frac{762}{6.28} = 4.28 \text{ cu. ft. per minute.}$$

$$\text{i.e., only } \frac{4.28}{9,230} \times 100 = 0.046\%$$

and of hydrogen only about

$$(0.725 \times 1 \times 0.0177) \times \frac{762}{6.25} = 1.56 \text{ cu. ft. per minute.}$$

Both these quantities, however, are very small and will be neglected.

After leaving the scrubbers the gas should be passed direct to the lime boxes where the CO_2 will be removed.

Volume of gas = 13,300,600 cu. ft. per 24 hours.
= 9,250 cu. ft. per minute at 20°C .

Diameter of main carrying gas from scrubber to purifiers

$$= \sqrt{\frac{9,250}{60 \times 60 \times 0.780}} = \sqrt{3.28} = 22 \text{ inches.}$$

Quantity of CO_2 to remove = 4 per cent. = 528,350 cu. ft.

$$= \frac{528,350}{385} \times 44 = 60,400 \text{ lb. per 24 hours.}$$

$$= 27 \text{ tons per day.}$$

$$= \frac{27 \times 74}{44} \times \frac{1}{0.65}$$

$$= 70 \text{ tons lime per day.}$$

$$35 \times 240$$

If lime is available at 10s. per ton = $\frac{35 \times 240}{8,540}$ = 1d. per

1,000 cu. ft. H_2 . As this is a large quantity of lime to handle means of avoiding part of this expenditure will be suggested. The cost would not be so much as a second washing under pressure.

In the Lane hydrogen plant where 2 to 2.5 per cent. of CO_2 are present in the issuing gas they allow a box area of $8 \times 45 \times 40 = 14,400$ sq. ft. for 9,000,000 cu. ft. per day,

$$i.e., \frac{14,400}{9,000} = 1.6 \text{ sq. ft. per 1,000 cu. ft. per day.}$$

So that in this case, allowing 3.0 sq. ft. per 1,000 cu. ft. per day, considering the increased quantity of CO_2 in the gas, $3 \times 13,300 = 40,900$ sq. ft. of box area would be required, or an installation nearly three times the size, *i.e.*, 24 boxes. This part of the installation is very cumbersome. It is indeed quite possible, if the Badische was running well, that only 3 per cent. of CO would be present in the final gas, and perhaps 16 boxes would suffice, but even so it would be necessary to have a sufficient size of installation to prevent any CO_2 passing through.

Ammonia Scrubbers

It would be practicable to install ammonia scrubbers between the cooling scrubbers and the lime box. In such case only *half* the above lime box installation would be required, *viz.*, 12 boxes, and very much less lime would be expended (only about one quarter).

Suppose the ammonia is to remove 3 per cent. of the CO_2 , *i.e.*, 45,000 lb. per day,

$$= \frac{(45,000 \times 34)}{89.7} \text{ lb. of } \text{NH}_3 \text{ per day.}$$

$$= 34,800 \text{ lb. } \text{NH}_3 \text{ per day.}$$

$$= 15.5 \text{ tons } \text{NH}_3 \text{ per day.}$$

$$= \frac{15.5}{89.7} \times 100 = 17.3\% \text{ of the total } \text{NH}_3 \text{ produced.}$$

This would be used as a 5 per cent. solution = $310 \times 224 = 70,000$ gal. per day,

and could produce $\frac{15.5 \times 136}{34} = 62$ tons of ammonium sulphate per day (allowing for no losses).

The excess of hydrogen allowed throughout the above notes (in case of losses) is

$$\frac{1,110,000}{8,540,000} \times 100 = 13\%$$

so it could be arranged that only about 7 per cent. of the ammonia budgeted for would have to be used for absorption of CO_2 and converted to carbonate (or then to sulphate). The rest could be made into ammonium nitrate.

This ammonia scrubbing could be carried out for the whole of the ammonia, if ammonia nitrate did not have to be made,

but even then the water scrubbing would be necessary (the size of the installation, however, could be reduced, as the pressure for removal of half the CO_2 would not have to be so great). It should be mentioned that in other plants the 1.0 to 1.75 per cent. CO_2 remaining after water washing is taken out by soda scrubber under pressure. This is troublesome and costly.

From the requirements for ammonia scrubbing for the removal of 3 per cent. of the CO_2 in the gas from the fractional combustion catalysers,

Absorption of 3% = 75% of the total CO_2 .

Time required for absorption, if velocity constant = 0.2

$$\frac{0.04}{0.2} = \frac{2.3 \log 0.01}{0.2} = 1.15 \log 4$$

$$= 1.15 \times 0.62 = 0.71 \text{ seconds.}$$

The volume of gas makes it unsuitable to use a bubbler type of plant, for about 10 bubblers in parallel would be needed to pass the gas, but a ring filled scrubber would be suitable.

For 3/4 second's contact, the scrubbers, if 10 ft. high, would allow a gas velocity of $\frac{4}{3}$ \times 10 = 13.3 ft. per second.

Area of scrubber 6 ft. in diameter = 28.2 sq. ft. in area (gross)

$$(if 3-inch ring filled) = \frac{28.2 \times 40}{100} = 11.3 \text{ sq. ft.}$$

Hence, volume passing through each scrubber per second
= 11.3×13.3
= 150 cu. ft. per second.
= 9,000 cu. ft. per minute.

Volume of gas to be passed = 9,250 cu. ft. per minute.

Hence one scrubber would suffice. It would not be necessary to install more than one scrubber as it is not desired to absorb all the CO_2 in ammonia, but arrangement to extend if required, so that all the NH_3 could be used for the absorption of CO_2 , could be made: in such case some of the CO_2 would be supplied from the water washing plant. The scrubbers could be constructed of steel plates.

The volume of 5 per cent. ammonia solution required is

$$\frac{700,000}{1,440} = 48.6 \text{ gal. per minute.}$$

A small pump would be arranged to throw this quantity of liquor countercurrent to the gas through the scrubber. The subsequent treatment of the ammonium carbonate liquor would be carried out in the neutralisation and evaporation section.

Resinous Products for Road Surfaces

With a view to finding new outlets for the production of resinous products in the Landes district of France, the "Comité Départemental des Résineux de la Gironde" recently opened two competitions, with prizes awarded for inventions, one of which paid special attention to the utilisation of resinous products in road surfacing. Official practical tests were recently made in France for rosin used in road surfacing and it was reported that the addition of the resinous pitch to the coal tar used for road surfacing has the advantage of greater smoothness, a better adherence to the ground and lasts longer.

A PROFESSOR of chemistry at Aarhus University, Aarhus, Denmark, is reported to have discovered a new explosive while working with a locally manufactured heart stimulant called "Nicordamin." The new explosive is stated to have a high safety factor as it does not react to chance disturbances. The explosion period is said to be very short.

Personal Notes

MR. J. DOUGLASS, retired chemist, of Coventry, left £14,800, with net personality £2,327.

MR. GEORGE S. HAMILTON, chemical manufacturer, Dundee, left estate valued at £12,323.

MR. J. M. CALEY, formerly pharmacist at the Royal Hospital, Wolverhampton, left £1,399, with net personality £743.

MR. T. R. KAY, of Southport, one of the founders of James Kay and Sons, Ltd., soap and oil manufacturers, left £16,777, with net personality £15,136.

SIR HARRY McGOWAN, chairman of Imperial Chemical Industries, was unanimously elected an honorary member of the Irvine Burns Club at the annual business meeting of the club.

PROFESSOR I. M. HEILBRON delivered the Jubilee Memorial Lecture of the Society of Chemical Industry to the Nottingham Section on January 16. His subject was "Chemical Elixirs of Life."

LORD and LADY TRENT and the HON. MARY BOOT left England on January 22 in the "Berengaria" for New York, en route to New Zealand and Australia. They expect to be away until May.

MR. COLIN MCRAE, King Edward Street, Alexandria, has been presented with a wallet of Treasury notes from the managers and foremen of the Alexandria works of the United Turkey Red Co., Ltd., on the occasion of his retirement after 67 years' service. He is 75 years of age, and for the past 52 years was a foreman with the company.

SIR JOHN F. BEALE, K.B.E., J.P., of Oulton Broad, Suffolk, and 4 Whitehall Court, London, S.W., known in the iron and steel industry throughout the world, chairman and managing director of Guest, Keen and Nettlefolds, Ltd., chairman of British (Guest, Keen, Baldwins) Iron and Steel Company, Ltd., and a director of twenty-seven other companies, including the L.M.S. Railway Company, the Midland Bank, Powell Duffryn Associated Collieries, Ltd., and Dundalk, Newry, and Greenore Railway, Ltd., and a well-known yachtsman, who died on December 9 last, aged sixty years, left estate of the gross value of £35,726 (net personality £21,896).

MR. J. BARDSLEY, analytical chemist, of Lytham, left £38,644, with net personality £37,758.

MR. H. W. MORRISON, a director of the Trinidad Oilfields Co., died on January 13 at the age of 72.

MR. D. M. STRATH, who has been a director of Ogston and Tennant, soapmakers, Renfrew, since 1918, has retired.

MR. G. L. HARBACH, a member of the Institute of British Foundrymen, read a paper last week on "Relationships in Cast Iron Test Results" to the Newark Engineering Society.

SIR HARRY McGOWAN gave an introductory speech prior to the showing of a film entitled "The Farmer's Holiday" at Nottingham recently.

MR. MAURICE LEES, J.P., of Ashton-under-Lyne, chairman and managing director of H. Lees and Sons, Ltd., iron manufacturers, for nearly 25 years Mayor of the Manor of Ashton, and a Freeman of the Borough of Ashton, left £27,288, with net personality £25,572.

SIR WILLIAM BRAGG has been awarded the Faraday Medal by the Council of the Institution of Electrical Engineers. The Faraday Medal is awarded not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering, or for conspicuous service rendered to the advancement of electrical science, irrespective of nationality.

AT A MEETING of the board of the Institute of Physics on January 14 the following were elected to membership: Fellows: E. S. L. Beale, A. B. D. Cassie, J. G. Holmes, N. Levin, A. S. Roy, A. M. Thomas and J. West; Associates: G. O. Baines, D. E. Barnes, R. Cockburn, M. Datta, R. W. Douglas, H. J. Frost, W. H. Hoather, J. L. Houghton, R. V. Jones, W. J. Lewis, F. C. Poultney, B. B. Ray, G. O. Stephens, A. E. Tooke and F. A. Vick; Ordinary members: G. Gardiner and J. A. V. Shone; Students: A. W. Brewer, G. R. Cooper, B. C. Godbold, A. W. Ireland, J. M. Leckingham, L. Mullins, H. A. Standing, W. E. Tomkin, F. H. Vanstone, R. W. White, F. G. Wilde and E. C. Woods. A certificate in laboratory arts, awarded under the Institute's recently introduced scheme for the proper certifying and training of laboratory and technical assistants in physics, has been granted to J. H. Houston.

Continental Chemical Notes

Sweden

A NEW TYPE OF SAFETY MATCH with improved moisture resistance has been introduced by Svenska Tändsticks Aktb., under the name of "Fenix."

Russia

OZONE IS REPORTED TO BE AN EFFECTIVE DESULPHURISING AGENT for petrol, particularly if the treatment is supplemented by steam distillation in presence of chalk. The optimum temperature for the ozone treatment is -20°C . Other advantages claimed to result from the treatment are reduction in iodine value, reduction in the naphthenic hydrocarbons and an increase in the proportion of saturated and aromatic hydrocarbons (Kiryanov and Sonslina, quoted in "Chimie et Industrie," December, 1935).

France

CATALYTIC OXIDATION OF ANTHRACENE to anthraquinone is now practised on an extensive scale by the Etablissements Kuhlmann at the Villers Saint-Paul works.

THE SAINT-GOBAIN CO. has now commenced the manufac-

ture of liquid sulphur dioxide, sodium bisulphide and sodium metabisulphite.

WITH A CAPITAL OF 625,000 FRANCS the Société des Produits Colorants et Plastiques has been formed at 46 rue Denis-Papin, Colombes (Seine). One of its declared objects is the exploitation of certain patents relating to new insoluble pigments.

A MIXTURE OF ETHYLENE OXIDE (1 part) and carbon dioxide (6.5 parts) is recommended by Melis and Lepiore for disinfection of tobacco bales. Treatment is carried out in evacuated chambers for two hours when rapid destruction of insect pests is effected ("Revue Internationale des Tabacs").

CERIUM METAL OF 97 PER CENT. PURITY has been prepared by A. Karl ("Bull. Soc. Chim.", 1935, p. 871) by reducing cerous chloride with commercial calcium in accordance with the equation $2 \text{Ce Cl}_3 + 3 \text{Ca} = 3 \text{CaCl}_2 + 2 \text{Ce}$. Ferrocerium is also readily prepared by this reaction, the calculated amount of iron being added before or after the treatment with calcium. A typical alloy produced in this manner had the composition: Cerium 63.4 per cent., iron 33.8 per cent., copper 1 per cent., calcium 0.3 per cent., and 0.2 per cent. magnesium.

Society of Chemical Industry

Preparations for the Liverpool Meeting

AN inaugural meeting for the purpose of appointing local committees in connection with the annual meeting of the Society of Chemical Industry on July 6 to 10 was held at the Liverpool Town Hall on January 20, when the Lord Mayor (Councillor R. J. Hall), who presided, welcomed the members of the Liverpool Section. He was accompanied by Viscount Leverhulme.

Professor C. O. BANNISTER, proposing the election of a representative reception committee, to be presided over by Viscount Leverhulme, said the event was of outstanding importance, and all leaders of chemical industries made a point of attending. Liverpool was the centre for a previous successful meeting in 1924, and it was good for the city to have an opportunity of showing its capabilities. American delegates to the Chemical Engineering Congress in London would also be their guests.

Alderman EDWIN THOMPSON seconded and the reception committee was elected. Its members include the Lord Mayor of Liverpool, Professor E. C. C. Baly, Dr. J. P. Baxter, Major D. J. Burke, Sir G. C. Clayton, Dr. A. C. Cumming, Alderman Burton W. Eills, Dr. H. H. Evers, Dr. A. Fleck, Dr. H. J. W. Hetherington, Alderman L. Hogan, Sir Richard D. Holt, Sir Benjamin Johnson, Professor W. C. McC. Lewis, Sir Frederick J. Marquis, Dr. C. J. Peddle, Professor A. Robertson, Sir W. Peter Rylands, Col. Sir John J. Shute, Capt. C. Norton Stafford, Alderman Edwin Thompson, Mr. J. W. Towers, Alderman F. C. Wilson and Lord Cozens Hardy.

Professor ABEL, who proposed the election of the executive committee, remarked that he was instructed to offer the facilities of the University lecture rooms, etc., for the use of the Society.

Mr. R. R. BUTLER, Principal of the Municipal Technical College, in seconding, offered the use of the large hall at the College if required.

The LORD MAYOR said no function in his year of office would be more important, and the holding of the annual meeting in Liverpool would add to the prestige of the city.

Lord LEVERHULME remarked that, as chairman of the reception committee, he would do his utmost to look after the guests, who would also be welcomed at Port Sunlight.

Man and the Mass

Sir Ernest Benn on the Task of Civilisation

SIR ERNEST BENN, chairman of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, was given a warm welcome when, as president of the Advertising Association, he visited the Publicity Club of Leeds on January 17 and addressed the members on "Man and the Mass." He said the appeal of the advertising man was to the individual, and his appeal was based on diversity, difference, novelty and competition. Advertising was the study of the wants of man and how to supply them. The basis of it was Voltaire's dictum that the luxuries of yesterday were the comforts of to-day, and the necessities of to-morrow. That was a complete answer to the statement that advertising created fictitious needs, and it was striking to reflect that it was in those businesses which Parliament was called in to help that the advertising idea had never taken root.

Referring to free advertising, Sir Ernest said that in his young days there was a clear distinction that the business man paid for his advertising and the politician got it for nothing, but to-day politics had become a trade, and a large section of the politicians were actually making a living out of it. A million officials, locally and nationally, were battening on to it as a trade, and it was for those engaged in the newspaper business to consider where they stood in giving free publicity to people who were largely engaged in making

our lives as miserable as possible. The unfortunate person who was engaged in the milk trade had to pay taxes, and he had to pay his whack in the advertising way to get a little bit of business, and this money was used to provide free space for the antics of the Milk Marketing Board, which existed to put him out of business. That was the sort of development which had not been sufficiently considered, probably because it was new.

Sir Ernest confessed he was frequently told that he did not realise that we were living in a new world. It was in many ways a new world, but in essentials and fundamentals, in the things that mattered, it was the same old world. The change which he saw was the tendency to push man into the mass. Part of this movement showed itself in the urge to organise and co-operate, and to propagate the League of Nations idea. As a child he felt the pinch which his parents experienced in paying for his education, and he determined to repay the debt, but now the boy was pushed into a machine, millions at a time, and he felt no obligation to anybody. If he was lucky enough to get a job when he left school he had to fall in to follow a standard pattern, and was warned that no funny tricks were wanted there.

When he was young he had the choice of many morning papers and nine evening papers in London, but now the same snippet of news was circulated among three million readers, and in half a day it was turned into public opinion. The wireless was another example of millions of people being given the same idea at the same moment. The job of civilisation was to re-discover man and get him back to a consideration of his own individual powers and individual soul, and there was in that ample scope for the activity of the advertising man.

Laminated Safety Glass

Use of Celluloid and Synthetic Resins

PLASTICS for laminated safety glass were the subject of a paper which Mr. J. Wilson, M.Sc., read before a joint meeting of the Society of Glass Technology and the Plastics Group of the Society of Chemical Industry on January 8.

A safety glass plastic, said Mr. Wilson, must be non-brittle, transparent, uniform in texture and in refractive index, free from objectionable foreign matter such as dust, hairs, etc., and it must be available in a form suitable for mass production methods of lamination.

The first plastic to be used, and one still extensively used, was celluloid. In addition to nitro-cellulose and camphor, celluloid usually contained small amounts of other substances such as water, alcohol, phthalates, dyestuffs, etc. The alcohol and water constant, small as it was, exerted a great effect upon the plasticity of the celluloid, and its behaviour during the lamination operation. The drawback to celluloid was that on exposure to light it lost its plasticity and became brittle. An alternative to celluloid was cellulose acetate plastic. This material did not possess the tensile strength of celluloid, but when used in the thickness of 0.025 inch instead of 0.020 inch it possessed an impact strength quite as high as that of the best product based on celluloid. Moreover, it did not become brittle on exposure to sunlight.

A number of other cellulose derivatives had been proposed, namely, regenerated cellulose and benzyl cellulose, but nothing appeared to have materialised. In recent years, many new synthetic resins had appeared and had been proposed as interlayers for safety glass. Among these resins were formaldehyde resins, acrylic acid resins, methylacrylic acid resins, vinyl resins, glyptals, etc. The acrylic acid ester resins possessed a remarkable elasticity, were watertight, stable to light and adhered reasonably well to glass. The great objection to the material was that films had to be formed directly on the glass by evaporation of solvent from the polymer. Another entirely different plastic proposed for a safety glass interlayer was gelatine, but this lacked strength.

New Technical Books

INDUSTRIAL AND MANUFACTURING CHEMISTRY (INORGANIC). Edited by Geoffrey Martin, Ph.D. The Technical Press, Ltd. Vol. I. 5th. edn. : pp. 496. 28s. net.

A treatise on technical inorganic chemistry, which includes accounts not only of the more important industries, but also details of the minor ones, has been a long-felt want amongst practical business men interested in chemical processes of manufacture. This combination, which embraces both British and American practice, affords, so far as is ascertainable in view of the many secret processes employed, thoroughly up-to-date information regarding the various branches of chemical industry and of manufactures having a chemical basis. Very full use has been made of patent literature and readers who desire further details respecting any process described will be enabled, without difficulty, to refer to the original source. The editor's aim has been to cover the whole range of subjects with which the industrial chemist and manufacturer are usually concerned, and to present a book which would serve either as a text book or as a work of reference to meet the requirements of business men interested in chemical processes, chemists, chemical engineers, patent workers, inventors, students and others. The work should prove of real utility to all interested in chemical manufacture. It should be mentioned that while the title indicates that only inorganic compounds are dealt with, a number of organic compounds have been included in the sections on disinfectants and antiseptics. The compounds fall naturally under these headings and their removal would destroy the value of the chapters concerned.

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DIE BESTIMMUNGEN DER WASSERSTOFFIONEN-KONZENTRATION. By Holger Jörgensen. Pp. 204. Dresden and Leipzig : Theodor Steinkopff. Paper, RM.15; bound, RM.16.

The considerable literature now available on the technique of measurement of hydrogen ion concentrations and their applications to biology and industry is distinctly enriched by the handy volume under review, the author of which appropriately worked under the inspiration of S. P. L. Sørensen, in the Carlsberg Laboratory, at Copenhagen. In practice the largest hydrogen ion concentration measured (e.g., normal hydrochloric acid) is no less than 10^{11} times as large as the smallest (e.g., normal caustic soda). Expression of results would thus in many cases have called for astronomical figures had not Sørensen conceived the happy idea of adopting the negative logarithm in place of the ionic concentration itself. In 1922, only 13 years after the introduction of Sørensen's pH conception, W. Mansfield Clark was able to remark that in certain departments of research pH was being used with as much frequency as $^{\circ}\text{C}$.

The author has divided his book into general and technical sections. In the former he first traces the development of the ionic theory which was born in the classical researches of Faraday, and successively elaborated by Hittorf, Kohlrausch, Arrhenius, van't Hoff and Wilhelm Ostwald. There follow sections dealing adequately, among other topics, with the law of mass action in relation to electrolytic dissociation, Nernst's work on ionic electromotive force, Sørensen's introduction of the pH conception, buffer solutions, colorimetric estimation of hydrogen ion concentrations and the quinhydrone electrode. The chapter on recent theories of electrolytic dissociation is a first-rate approach to the important work of Lewis, Bjerrum, Debye and Hückel. Before proceeding to actual illustrations of the technical applications of pH measurements, a short section of 50 pages deals with the practical side of both electrometric and colorimetric methods of estimation. The book is thus a welcome combination of the theoretical and practical. Three groups of applications are discussed in the technical section, comprising respectively those based upon direct action of hydrogen ions (e.g., purifi-

cation of cane sugar juice and the setting of gelatine), those depending upon indirect action of ions (e.g., enzyme action, casein manufacture, paper sizing) and, finally, those in which the influence of pH has not yet been explained (e.g., ropiness of bread, dyeing of wool, leather and paper, action of rennet, consistency of cheese and the antiseptic action of benzoates). On the whole, the author has dealt lucidly and comprehensively with his intricate material and the work deserves a hearty welcome among chemists in all fields.

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TECHNOLOGY OF COLLOID CHEMISTRY (Kolloidchemische Technologie), by Dr. Ralph, Ed. Liesegang, Frankfurt. Theodor Steinkopff, Dresden and Leipzig. 2nd edition.

A technical book of considerable extent which can appear in a second edition after a comparatively short space of time since its first appearance is guaranteed, by this fact alone, a most appreciative judgement. This is specially the case with books on chemical technology, for there is in this field a standard work in Ullmann's encyclopædia of chemical technology, which is unsurpassed all over the world. (Moreover that also is now in its second edition.) Dr. R. E. Liesegang and his collaborators are well aware of this fact. They wisely confine themselves to "A Handbook of Observations on Colloid Chemistry in the Chemical Industry and its Technique." In this limitation of sphere lies the great strength of the book. Liesegang has understood how to attract in the various branches of chemical technology not only specialists, but, one may say, the very best experts in these special fields. Therefore his "Technology of Colloid Chemistry" possesses a particular attraction and great value. The work is composed of a large number of expert contributions in which one can see the directing hand of Liesegang, but these, however, reflect a pleasant individuality. Among the contributions are the following: Dr. Josef Reitstötter, "The production of colloid solutions of inorganic materials"; Dr. Paul Mautner, "Adsorption (de-colouring) materials"; Professor Werner, "Active Carbon"; Otto Manfred, "Plastic materials"; Dr. Rudolf Koetschau, "Destruction of emulsions in the petroleum industry"; Dr. Erwin Mayer, "Elektro Osmosis"; A. Retter, "Fertilisers."

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LES MATERIAUX CONSTITUTIFS DE L'APPAREILLAGE CHIMIQUE, LEUR RESISTANCE A LA CORROSION, by I. Scriabine. Librairie Polytechnique Ch. Béranger, Paris.

This small work aims at presenting in a brief survey the knowledge of materials employed in constructing apparatus for the chemical industry, as this is most important for the industrial chemist. This branch of applied chemistry becomes larger every day with the introduction of new alloys and materials of organic origin. After treating the factors which decide the choice of materials—price, chemical resistance, thermal conductivity and mechanical properties—the author gives some chapters on the theory of corrosion, iron and its alloys, non-ferrous metals, non-metallic mineral materials, refractory materials and materials of organic origin, all of which are of equal interest to the ceramist as to the chemist. The text is accompanied by 23 graphical illustrations. A short account like this shows what a number of facts the book contains. It is therefore as interesting as valuable because of these facts. Nevertheless it has the same fault as most of these books about engineering materials for the chemical engineer; as much attention is given to the theory of corrosion, the fact of corrosion of all metals and innumerable corrosion protections, as to study and work. But in most of these cases the only right and necessary conclusion is not drawn, namely, instead of using corroding metals, to employ engineering materials—different ones in particular cases—which are absolutely resistant (except in the case of hydrofluoric acid) to acid attack and which need no protector against corrosion. Such engineering materials have been developed during these last years in an astonishing manner. They are ceramic materials like porcelain, stoneware, etc.

From Week to Week

EMPLOYEES OF THE LEVENBANK WORKS, Jamestown, which belong to the United Turkey Red Co., Ltd., subscribed £59 to charities during the past year.

A NEW INDUSTRY has started at Pumpherston, West Lothian, where bricks are being made from the waste bings of the shale mines and slag. The bricks will be used for building houses in the locality.

THE SYNTHETIC NITRIC ACID FACTORY of the Showa Hiryo K.K., at Kawasaki, has now commenced production with a daily output capacity of 10 tons, although the present actual production comprises 5 tons dilute acid and 3 tons concentrated acid.

THE CENTRAL COMMITTEE of California petroleum producers, which has been revived in order to cope with the over-production of crude oil in that State, has voted the limitation of the California crude oil output to 600,000 barrels a day, which represents a reduction of about 80,000 barrels compared with the present output.

A UNITED STATES DISTILLERY COMPANY is negotiating with a Glasgow firm for the purchase of a Scottish distillery. The firms are the Distillers and Brewers Corporation of New Jersey, and A. P. McDowell and Co., Ltd., Glasgow, a subsidiary of Black Brothers. The vice-president of the American concern is on his way to Glasgow.

WITH THE FEBRUARY ISSUE, published this week, Hutchinson's "A to Z Time Tables" appears in entirely new and revised form and justly claims to be complete—giving all train, bus, coach, air and steamship services in Britain and to the principal places abroad. Nine months of hard labour, it is stated, have gone into the production of this book. The whole arrangement is simple and easily understood, and there are 32 maps.

THE TECHNICAL PRESS, LTD., has published a leaflet giving a selection of its publications of particular interest to industrial chemists. Among the books listed are:—"Industrial and Manufacturing Chemistry," in two parts, by Geoffrey Martin; "Chemical Analysis," by W. W. Scott; "The Chemistry of Petroleum and its Substitutes," by C. K. Tinkler; "Standard Methods of Chemical Analysis," by W. W. Scott.

SPEAKING AT A DINNER following the opening of premises for Industrial Gases (I.F.S.), Ltd., in Dublin, the Irish Free State Minister of Industry and Commerce, Mr. Sean Lemass, said the concern was one of importance in a country which had been backward in the development of chemical industries. It was a fact, however, that, because of lack of experience and technical skill, their own people, unaided, could not bring them into being; consequently they had to seek aid from external companies. He was glad to say that that aid had been extended freely in the past, and in that particular case Industrial Gases (I.F.S.), Ltd., had been fortunate in securing the co-operation of the British Oxygen Co., which bore a reputation unparalleled in the world. Industrial Gases (I.F.S.), Ltd., will manufacture oxygen and dissolved acetylene for the Irish Free State.

THE FIFTH ANNUAL DINNER of the Scottish Dyes Foremen's Association was held at Grangemouth last week, when Mr. A. Primrose, chairman, presided, and was supported by Mr. J. M. Weir, Dyestuffs Group manager and director, Manchester; Mr. G. K. Grounds, labour manager, Huddersfield; Dr. W. G. Hiscock, works manager; Dr. Goldblatt, Dyestuffs Group medical officer, Manchester; Mr. W. D. Rogers, Manchester; Mr. E. E. Randolph, chief analytical chemist, Huddersfield; Dr. R. F. Thomson, research manager, Grangemouth; Mr. E. Hughes, assistant works manager; Mr. T. J. Davies, Mr. J. Morgan, and Mr. A. D. Dandridge, heads of departments; Mr. R. W. Gordon, chief engineer, and Mr. J. C. Stewart, labour manager. The toast of "Imperial Chemical Industries" was proposed by Mr. G. W. Irving, and replied to by Mr. J. M. Weir; "Our Guests" was proposed by Mr. H. Crawford and replied to by Mr. W. D. Rogers, Mr. G. K. Grounds, and Dr. M. W. Goldblatt. In the course of the evening Dr. Hiscock's bowling prizes were presented.

THE ENCOURAGING OUTLOOK contained in the Board of Trade returns for December not only affords a striking indication of Great Britain's industrial recovery, but this trade activity is being reflected in the china clay industry. The year 1935 was an exceptional period in the potteries as a result of the extraordinary demand for china commemorating the Jubilee, and apart from this fact there has been a greater demand for china-ware, factors which have reacted on the china clay, china stone and ball clay industries. The details of the December shipments are:—Fowey—44,117 tons of china clay, 2,831 tons of china stone, 1,584 tons of ball clay. Par—7,237 tons of china clay, 345 tons of china stone. Charlestown—4,090 tons of china clay. Padstow—258 tons of china clay. Plymouth—139 tons of china clay. Newham—40 tons of china clay. Sent direct by rail—4,715 tons of china clay. Making a total for the month of 60,596 tons of china clay, 3,176 tons of china stone, 1,584 tons of ball clay. The turnover for 1935 included 717,752 tons of china clay, 42,338 tons of china stone, 25,380 tons of ball clay. Compared with 702,612 tons of china clay, 37,382 tons china stone, 14,771 tons ball clay during 1934.

THE EXECUTIVE BOARD OF MINING RESEARCH of Birmingham University has issued a report on the work that has been done in the mining research laboratory during the fifteen months ended March 31, 1935.

THE INAUGURAL MEETING of the Northern Branch of the Institution of Petroleum Technologists and the lecture by Sir John Cadman, G.C.M.G., on "The Application of Science to the Petroleum Industry" have been postponed owing to the death of King George.

FOUR MEN WERE INJURED in an explosion on the premises of an oil refiner at Ormond Yard, London, on January 16. The men were taken to hospital suffering from burns, and two were detained. The explosion shattered several windows, and the fire brigade had to be called to extinguish the flames.

A NEW CALCIUM CARBIDE FACTORY is reported from an American source to be under construction at Los Andes in the south of the country. An annual output of 5,000 tons is anticipated and production is to commence in March of this year. Since the domestic consumption is only 3,000 tons, the surplus will be available for export.

TWENTY-ONE OFFICERS attached to the Criminal Investigation Departments of fifteen city and county police forces have completed a course at Hull University College on Scientific aids to the detection of crime. The course was given by Professor F. G. Tryhorn, Professor of Chemistry, who had given expert evidence in many criminal cases. Another residential course approved by the Home Office will be given at Easter.

PLANS HAVE BEEN PASSED for an important extension to the colour factory of the Strathclyde Paint Co., Ltd., at Glasgow. Hitherto the manufacture of fine colours from aniline dyes, which forms one of the products of these works, has been confined to a large extent to factories south of the border. The new factory, when completed, will be equipped with up-to-date plant for the manufacture of a large variety of fine chemical colours.

ANOTHER STEP TOWARDS RESTARTING the Jarrow Steelworks, after their fifteen years' idleness, was announced on January 20, by Mr. E. Hargreaves, the Jarrow representative of Thomas W. Ward, Ltd., who stated that the option-holders had taken over the whole works from his firm. The dismantling of the old works, which has been in progress for some time, will be accelerated to make way for the new and larger premises, which will take two years to erect. The new plant will have an annual output of 500,000 tons of steel. In addition it may be decided to lay down coke ovens.

WHAT IS STATED to be the first commercial motor vehicle to be driven by gas made from anthracite coal was given a test run, on January 17, near the factory at Aix-la-Chapelle, where it was built. The anthracite gas is stated to be cheaper than liquid fuel. The vehicle is driven by a modified form of Diesel engine and, it is stated, can be run on fuel oil instead of an anthracite coal gas by the replacement of a number of engine parts. The gas-production equipment of the vehicle, a bus seating 37 people, gives sufficient fuel for about 300 kilometres. During the test the vehicle was driven at only 50 kilometres an hour. Germany is experimenting on a large scale with such vehicles in order to reduce imports of petroleum from abroad.

Company News

W. J. Bush and Co.—The payment of 5 per cent., less tax, is announced on the ordinary shares.

Redfern's Rubber Works, Ltd.—Dividends have been declared on the share capital of the company at the rate of 3½ per cent. on the "A" and "B" preference shares, making 7½ per cent. for the year, and 10 per cent. on the ordinary shares, making 12½ per cent. for the year. The annual general meeting will be held on February 15, at 11.30 a.m., at Hyde.

New Companies Registered

Manor Water Softener Co., Ltd., Manor Works, Spring Hill, Birmingham.—Registered January 20. Nominal capital £1,000 in £1 shares. To acquire the business of a manufacturer of water softeners and water softening apparatus now carried on by Leo. S. Davies at Manor Works, Spring Hill, Birmingham; as "The Manor Water Softener Co." Directors: Leo. S. Davies (managing director of Birmingham Metal Stamping Co., Ltd.) and Mrs. Brenda E. Davies.

Medway Synthetic Products, Ltd., The Bungalow, Gillingham Green, Gillingham, Kent.—Registered January 16. Nominal capital £12,000. Manufacturers of and dealers in chemicals, essences, essential oils, synthetic products, gases, drugs, medicines, etc.

Inventions in the Chemical Industry

Patent Specifications and Applications

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

WORKING UP OF ORES and other materials containing mixtures of oxides of volatile metals, for example, lead oxide with zinc oxide.—G. Polensky, O. Polensky, and F. Polensky (trading as Polensky and Zollner). July 4, 1934. 14976/35.

ALKYL ESTER SALTS, process for production.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 3, 1934. 18465-6/35.

TREATING MIXTURES CONTAINING FREE ACID and acid alkyl esters, process.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 3, 1934. 18467/35.

ALLOYS CONTAINING BORON, process for manufacture.—Soc. d'Electro-Chimie, d'Electro-Metallurgie, et des Acieries Electriques D'Augine and J. L. Andrioux. July 2, 1934. 18950/35.

VAT DYESEUFFS, manufacture.—I. G. Farbenindustrie. July 4, 1934. 19139/35.

ACTIVATED CARBON in granular form, process for production.—I.A.C. Soc. per l'Industria Articoli di Caoutchouc E per Materiali Protettivi E Antigas. July 4, 1934. 19149/35.

AMINO ALCOHOLS, manufacture.—I. G. Farbenindustrie. July 5, 1934. 19270/35.

EXTINGUISHING OF FIRES in rooms.—Soc. of Chemical Industry in Basle. July 7, 1934. 21138/34.

REFRACTORY PRODUCTS from raw materials rich in magnesium orthosilicate particularly olivine rocks, process for manufacture. V. M. Goldschmidt. July 13, 1934. 1848/35.

LUBRICATING OILS.—Standard Oil Development Co. July 7, 1934. 5716/35.

MORPHOLINE and certain homologues thereof, manufacture.—Carbide and Carbon Chemicals Corporation. July 12, 1934. 15709/35.

INSECTICIDE AND ANTICRYPTOGAMIC CHEMICALS and process and means for manufacturing them.—L. Ferri. June 7, 1934. 15999/35.

NEW DERIVATIVES OF PYRAZINE-MONOCARBOXYLIC ACID, process for manufacture.—K. Merck, W. Merck, L. Merck and F. Merck (trading as E. Merck (firm of).) July 7, 1934. 16970/35.

CITRACONIC ACID and ITACONIC ACID, manufacture.—C. H. Boehringer Sohn A.-G. July 7, 1934. 17233/35.

STABILISATION OF VINYL RESINS and compositions produced thereby.—Carbide and Carbon Chemicals Corporation. July 10, 1934. 18154/35.

VALUABLE LIQUID HYDROCARBONS by destructive hydrogenation of carbonaceous materials, process for production.—International Hydrogenation Patents Co., Ltd. July 7, 1934. 18155/35.

SYNTHETIC RESINS, manufacture.—E. I. du Pont de Nemours and Co. July 13, 1934. 18339/35.

HYDROCYANIC ACID, recovery.—Röhm and Haas Co. July 9, 1934. 18582/35.

ALCOHOLS, process for production.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 7, 1934. 19061/35.

ZINC WHITE, production.—Zahn and Co., Ges. July 9, 1934. 12921/35.

TITANIUM DIOXIDE, method of making.—American Zinc Lead and Smelting Co. July 12, 1934. 19222/35.

Specifications Accepted with Date of Application

DYEINGS PREPARED ON CELLULOSE MATERIALS by means of substantive dyestuffs, treatment.—A. Carpanel (I. G. Farbenindustrie). June 1, 1934. 440,488.

AZO DYESEUFFS containing metals, manufacture and production. Coutts and Co. and F. Johnson (I. G. Farbenindustrie). June 21, 1934. 440,415.

PREPARING HIGHER LACTONES containing at least 11 carbon atoms in the lactone ring, methods.—W. W. Triggs (Soc. Anon. M. Naeff and Cie). June 21, 1934. 440,416.

SOLID TETRAZO-SALT, manufacture.—I. G. Farbenindustrie. June 24, 1933. 440,424.

ALUMINUM ALLOYS.—H. W. Clarke and L. Aitchison. June 28, 1934. 440,433.

WATER-IN-OIL EMULSION, process for manufacture.—E. I. du Pont de Nemours and Co. July 1, 1933. 440,575.

NAPHTHALENE DERIVATIVES, manufacture.—Imperial Chemical Industries, Ltd., M. Wyler and A. Kershaw. July 5, 1934. 440,733.

Injector means for dosing water with hypochlorite solution.—D. J. Evans. Sept. 20, 1934. 440,509.

GOLD- and SILVER-ZIRCONIUM ALLOYS.—Dr. W. Guertler. April 13, 1933. 440,450.

HYDROCARBON DISTILLATES, process for manufacture.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Nov. 4, 1933. 440,517.

DESTRUCTIVE HYDROGENATION of carbonaceous materials.—M. A. Matthews, L. G. B. Parsons, and Imperial Chemical Industries, Ltd. Dec. 4, 1934. 440,456.

PENTAERYTHRITE, production.—Lonza Elektrizitätswerke und Chemische Fabriken A.-G. Feb. 14, 1934. 440,691.

ELECTROLYTIC MANUFACTURE OF BORIDES.—Soc. D'Electro-Chimie, D'Electro-Metallurgie, et des Acieries Electriques D'Ugine, and J. L. Andrioux. March 17, 1934. 440,764.

1 : 2 DIAMINO-BENZENE, manufacture.—Soc. of Chemical Industry in Basle. April 12, 1934. 440,697.

DISAZO DYESEUFFS, manufacture.—J. R. Geigy, A.-G. April 12, 1934. 440,698.

NON-DECYL OXYGENATED COMPOUNDS, production.—Carbide and Carbon Chemicals Corporation. May 9, 1934. 440,539.

CALCINED TITANIUM OXIDE PIGMENTS, preparation.—Titan Co., Inc. May 19, 1934. 440,611.

SPECIFICATIONS accepted with date of application.

VAT DYESEUFFS, manufacture and production.—Coutts and Co. and F. Johnson (legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). Feb. 7, 1935. 440,822.

COMPOSITIONS CONTAINING SYNTHETIC RESINS.—H. E. Potts (Shawinigan Chemicals, Ltd.). April 5, 1934. 441,052.

COLOURING MATTERS.—Imperial Chemical Industries, Ltd., C. Child and H. A. Thomas. June 8, 1934. 440,983.

STABILISATION OF POLYMERISATION PRODUCTS.—I. G. Farbenindustrie. June 13, 1934. 440,957.

COARSELY CRYSTALLINE AMMONIUM SULPHATE, manufacture and production.—Coutts and Co. and F. Johnson (legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). July 2, 1934. 440,807.

SAFETY GLASS, process for manufacture.—W. W. Groves Deutsche Celluloid Fabrik. July 2, 1934. 440,887.

GLYCERIDES OF FATTY ACIDS, manufacture.—Imperial Chemical Industries, Ltd., T. P. Hilditch and J. G. Rigg. July 2, 1934. 440,888.

Applications for Patents

(December 19 to 24 inclusive.)

ESTERS OF METHACRYLIC ACID and their manufacture.—E. I. du Pont de Nemours and Co., D. E. Strain and H. J. Barrett. 35399, 35400, 35401.

MAGNESIUM, ETC., manufacture.—D. Gardner. 35540, 35541, 35542, 35543.

MAGNESIUM SULPHIDE and metallic magnesium, production.—D. Gardner. 35585.

DOLOMITIC ORES and production therefrom of magnesium, treatment.—D. Gardner. 35586.

PYRENEQUINONE containing nitro- or amino-groups, manufacture.—W. W. Groves (I. G. Farbenindustrie). 35570.

METHINE DYESEUFFS, manufacture.—W. W. Groves (I. G. Farbenindustrie). 35572.

DYESEUFFS of the anthracene series, manufacture.—W. W. Groves (I. G. Farbenindustrie). 35705.

NEW PRODUCTS from para-amino-phenylamine, manufacture.—W. W. Groves (I. G. Farbenindustrie). 35706.

PLASTIC COMPOSITIONS containing nitrocellulose.—Imperial Chemical Industries, Ltd., and H. T. Tattersall. 35777.

AZO DYESEUFFS, manufacture.—Imperial Chemical Industries, Ltd., and A. H. Knight. 35780.

COMPOUNDS OF THE ANTHRAQUINONE SERIES, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 35223.

VAT DYESEUFFS of the anthraquinone series, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 35326.

ORGANIC GOLD, SILVER AND BISMUTH COMPOUND, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 35327.

REGENERATION OF ALKALINE WASHING LIQUIDS laden with hydrogen sulphide, apparatus.—G. W. Johnson (I. G. Farbenindustrie). 35418.

NITROGENOUS CONDENSATION PRODUCTS of high molecular weight, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 35569.

REMOVING BISMUTH from copper, etc.—E. R. Lauber and O. Nielson. (Germany, Dec. 21, '34.) 35618.

CARBONYL COMPOUNDS, production.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (United States, Dec. 24, '34.) 35665.

(December 27 to 31 inclusive.)

PRECIPITATION OF COPPER from solutions containing copper, process.—Dr. K. Albert G. (Germany, Dec. 28, '34.) 35899.

ANTIMONY TRIOXIDE.—E. L. W. Byrne (American Smelting and Refining Co.). 35853.

AZO DYESTUFFS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 35869.

VAT DYESTUFFS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 35870.

SULPHUR DYESTUFFS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 35871.

WATER-SOLUBLE PHENOLIC CONDENSATION PRODUCTS, manufacture.—A. Carpmael (I. G. Farbenindustrie). 35902.

PHTHALOCYANINES, manufacture.—A. Carpmael (I. G. Farbenindustrie). 36085.

CONDENSATION PRODUCTS CONTAINING SULPHUR, after-treatment.—A. Carpmael (I. G. Farbenindustrie). 36086.

NEW ANILINE DERIVATIVES, manufacture.—S. Coffey, N. H. Haddock and Imperial Chemical Industries, Ltd. 36120.

ACETIC ANHYDRIDE, preparation.—Consortium für Elektro-chemische Industrie G. (Germany, Jan. 16.) 36033.

ORGANIC ARSENIC COMPOUNDS, manufacture.—A. J. Ewins and May and Baker, Ltd. 35995.

POLYGLYCOL ETHERS, manufacture.—W. W. Groves (I. G. Farbenindustrie). 36072.

VAT DYESTUFFS OF THE ANTHRAQUINONE SERIES, manufacture.—I. G. Farbenindustrie. (Germany, Dec. 29, '34.) 35978.

LIQUID HYDROCARBONS, ETC., manufacture.—G. W. Johnson (I. G. Farbenindustrie). 35975.

AZO DYESTUFFS, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 36075.

FRACTIONAL CONDENSATION, ETC., OF HYDROCARBON OILS, process.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij (Holland, Jan. 4). 36094.

ZINC SULPHIDE.—New Jersey Zinc Co. (United States, Dec. 28, '34.) 35814.

SYNTHETIC HYDROCARBON OILS, production.—Standard Oil Co. of California. (United States, Dec. 31, '34.) 35960.

(January 1 to 8 inclusive.)

CARBON DISULPHIDE, manufacture.—J. P. Baxter, R. J. Burrage and Imperial Chemical Industries, Ltd. 317.

RECOVERY OF AMMONIUM COMPOUNDS from ammonical liquors, etc., process.—A. G. Black and P. Evans. 574.

PIG IRON, treatment.—H. A. Brassert and Co., Ltd. 343.

ORGANIC SUBSTANCES, manufacture.—British Celanese, Ltd., and W. H. Moss. 133.

ALUMINIUM ALLOY, manufacture.—A. F. Burgess (A. O. Smith Corporation). (March 20, '35.) 152.

POLYMERISED BUTADIENES, manufacture.—W. H. Carothers, A. M. Collins, E. I. du Pont de Nemours and Co., and J. E. Kirby. 461.

ALKALI METAL HYDROXIDE SOLUTIONS, process for purification.—A. Carpmael (I. G. Farbenindustrie). 710.

POTASSIUM FORMATE, production.—Chemische Fabrik Buckau (Germany, Jan. 31, '35.) 323.

CELLULOSE DERIVATIVES, production.—E. I. du Pont de Nemours and Co. and F. Hahn. 699.

COLOURED RESISTS under aniline black, production.—Durand and Huguenin A.-G. (Germany, Jan. 14, '35.) 557.

SOLUBLE AROMATIC AMIDE COMPOUNDS of therapeutic value, preparation.—G. B. Ellis (Soc. des Usines Chimiques Rhône-Poulenc). 321.

FLUORINE AND ALUMINIUM, separating.—H. G. C. Fairweather (Kunstdünger-Patent-Verwertungs A.-G.). 462.

CARBOCYANINE DYESTUFFS, manufacture.—Gevaert Photo-Producent Naamlooze Vennootschap. (Austria, Jan. 8, '35.) 697.

MODIFYING ORGANOPHILIC HIGHLY POLYMERIC BODIES, process.—W. W. Groves (Aceta G.). 694.

PREVENTING HARMFUL DEPOSITION of carbonates contained in water.—F. Hahn. 263.

DESOXYMORPHINE C. and dihydro-desoxymorphine D., manufacture.—F. Hoffmann-La Roche and Co. j.-G. (Germany, Jan. 26, '35.) 655.

HALOGEN ALKYLAMINES, manufacture.—I. G. Farbenindustrie. (Germany, Jan. 9, '35.) 198.

CELLULOSE, production.—I. G. Farbenindustrie. (Germany, Feb. 13, '35.) 200.

VAT DYESTUFFS, manufacture.—I. G. Farbenindustrie. (Germany, Jan. 12, '35.) 290.

OBTAINING PEROXIDES and valuable metal, etc., process.—I. G. Farbenindustrie. 565.

ORGANIC FLUORINE COMPOUNDS, manufacture.—Imperial Chemical Industries, Ltd. 318.

PROTOPHENYLIC ALDEHYDE from heliotropine, preparation.—L. Mellersh-Jackson (L. Givaudan and Cie, Soc. Anon.). 483.

PIGMENTS CONTAINING ZINC SULPHIDE, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 52.

AZO DYESTUFFS, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 53.

PARTIALLY HYDROGENATED COMPOUNDS containing several nuclei, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 54.

CRYOLITE, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 464.

CARBON BLACK, manufacture.—G. W. Johnson (I. G. Farbenindustrie). 465.

ORGANIC FLUORINE COMPOUNDS, manufacture.—F. D. Leicester. 318.

NITRATES, manufacture.—H. Pauling. (Germany, Jan. 2, '35.) 203.

ALCOHOLS, ETC., manufacture.—Rohm and Haas Co. (United States, Jan. 15, '35.) 649.

SULPHUR, manufacture.—Soc. Generale Industrielle et Chimique du Katanga and M. Pourbaix. 190.

DYESTUFFS, manufacture.—Soc. of Chemical Industry in Basle. (July 8, '35.) (Switzerland, July 7, '34.) 692.

RECOVERY OF METALLIC MAGNESIUM, process.—W. H. A. Thiemann (I. G. Farbenindustrie). 714.

HYDROCARBON OILS, conversion.—Universal Oil Products Co. (United States, June 24, '35.) 376.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt as specified in the last available Annual Summary, is also given marked with an *—followed by the date of the Summary, but such total may have been reduced.)

Satisfactions

BRITISH CELANESE, LTD. (late British Cellulose and Chemical Manufacturing Co., Ltd.), London, W. (M.S., 25/1/36.) Satisfactions reg. Jan. 8, of deb. stock reg. Aug. 24, 1922, and July 6, 1923, to extent of £68,503 and of deb. stock reg. June 21, 1934, to extent of £44,117.

CELLON, LTD. (late Cellon (Richmond), Ltd.), London, E.C. mfrs. of dopes, etc. (M.S., 25/1/36.) Satisfactions reg. Jan. 11, £40,000, reg. July 2, 1928, £10,000, reg. Aug. 5, 1930, and £3,500, reg. Nov. 14, 1933.

L. B. HOLIDAY AND CO., LTD., Huddersfield, chemical mfrs. (M.S., 25/1/36.) Satisfaction reg. Jan. 14, of mort. reg. Feb. 18, 1925.

STRONTIUM PRODUCTS, LTD., Bristol, mine owners, etc. (M.S., 25/1/36.) Satisfaction reg. Jan. 14, of debts. reg. Feb. 17, 1927, to extent of £1,000.

UNITED PREMIER OIL AND CAKE CO., LTD., London, E.C. (M.S., 25/1/36.) Satisfaction reg. Jan. 8, of deb. stock reg. July 9, 1919, to extent of £371,465.

County Court Judgments

(NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court Judgments against him.)

HEWISON, Wm. Edwd., The Old House, Petersham, research chemist. (C.C., 25/1/36.) £32 1s. 3d. Dec. 17.

Companies Winding-up Voluntarily

BRITISH STARCH CORPORATION, LTD. (C.W.U.V., 25/1/36.) By reason of its liabilities. January 13. George Ronald Newman, 11 Queen Victoria Street, London, appointed liquidator. Debts or claims by February 11 to the liquidator.

Bankruptcy Proceedings

Z. SOLOMIDES, 30 Connaught Avenue, East Sheen, S.W.14, chemical manufacturer.—This receiving order was made on a creditor's petition, and the statement of affairs which has been filed in the proceedings shows liabilities of £2,372, with no assets. It appears that since 1924 the debtor had been manufacturing insecticides and similar preparations from his home address. The profits, however, have been insufficient to cover overhead and household and personal expenses. In 1933, in anticipation of a promised order from a company which held the sole selling rights of one of his preparations, he purchased chemicals to the value of £140 and manufactured two tons of this preparation, but the order failed to materialise, and, owing to deterioration, he had to destroy the whole quantity. The dry weather during the last three years had also affected his trade. The debtor attributes his failure to the profits being insufficient to cover both overhead and household and personal expenses, to decline of trade and loss of £140 in respect of order which did not materialise.

Forthcoming Events

LONDON

Jan. 27.—Institution of the Rubber Industry (London and District Section). Films entitled: "Quality in Rubber Cables," and "A Day of Enlightenment." 7.30 p.m. 12 St. James's Square, London.

BIRMINGHAM

Jan. 30.—Institute of Metals (Birmingham Section). "The Polishing of Metals." E. J. Dobbs. 7 p.m. James Watt Memorial Institute, Birmingham.

Feb. 1.—Midland Chemists' Committee. Annual Dinner-Dance. 6.30 p.m. Midland Hotel, New Street, Birmingham.

BRADFORD

Jan. 30.—Society of Dyers and Colourists (West Riding Section). "Technical Services applied to Sales and Advertising." F. P. Thompson. Bradford.

CARDIFF

Jan. 27.—Society of Chemical Industry (South Wales Section). "Recent Studies in the Mechanism of Chemical Reactions." C. N. Hinshelwood. 7.15 p.m. University College, Cardiff.

Jan. 31.—Society of Chemical Industry (South Wales Section). Smoking Concert. 7.30 p.m. Queen's Hotel, St. Mary Street, Cardiff.

HULL

Jan. 28.—Hull Chemical and Engineering Society. Joint meeting with the Hull Association of Engineers. "Water Treatment." P. Hauer. 7.45 p.m. Municipal Technical College, Park Street, Hull.

LEICESTER

Jan. 29.—Leicester Literary and Philosophical Society (Chemistry Section). Joint meeting with the Leicester Section of the Institution of the Rubber Industry. "Colour and Rubber." Dr. T. J. Drakeley. 7.30 p.m. College of Technology, Leicester.

Stocks and Shares

A Moderate Decline

On balance for the week there has been a moderate although fairly general decline in shares of companies associated with the chemical and allied industries. This is, of course, a reflection of market conditions and does not indicate that the market has revised its view that the results which fall to be issued this year will show increased profits and in some cases larger dividends as well. Imperial Chemical are virtually unchanged at 36s. 10½d. and have been steady. It has been mentioned in these notes before that the market is budgeting for a final dividend of 5½ per cent., which would maintain the dividend for the year at 8 per cent. British Drug Houses were less active, but have kept their recent improvement to 18s. 1½d. Cooper, McDougall have gone back to 38s. 9d. They are held firmly, and as the amount of shares available in the market is not large, the tendency is for only a relatively small amount of selling or buying to affect the price sharply. B. Laporte were active, having remained under the influence of the share bonus and new issue. The effect of the latter will be to extend the market in the shares in view of the larger amount of shares available. Fison, Packard & Prentice held up well. Gas Light and Coke ordinary were firm on the belief that the dividend will be unchanged. Boots Pure Drug have moved up further on balance. The market is now talking of the possibility of a larger dividend or of another offer of shares to shareholders on favourable terms; although it is realised that, as in the case of various other prominent industrial shares, the recent sharp rise in price may have been due in part to purchases by fixed trusts which include the shares in their portfolios. Distillers have lost their sharp gain of the previous week, but it is recognised there are reasonable grounds for the view that a larger dividend may be in prospect. United Molasses remained a prominent feature, but best prices were not held. William Blythe 3s. ordinary shares which recently rose 1s. to 7s. 1½d. have held up well. In this case it is being pointed out in the market that in respect of 1934 the 10 per cent. dividend was a conservative payment (fully 15 per cent. was earned on the shares) and that there are possibilities of a larger final dividend in March. In September the interim dividend was maintained at 3 per cent. Triple Safety Glass remained active and were not affected by the news as to the progress of the new glass "Perspex" manufactured by Imperial Chemical Industries by a special process from coal, as it is pointed out in the market that last year it was stated the company has "close commercial contacts" with I.C.I. United Glass Bottle ordinary shares have remained dull, the market now being less inclined to look for a further increase in the dividend in view of the talk of possible competition from tin containers in the brewery trade and the fact that the directors invariably follow a conservative dividend policy. Burt, Boulton and Haywood were again steady on hopes of a rather larger interim dividend. International Nickel were active, there being continued talk that an increase may be made in the next quarterly dividend. Borax Consolidated deferred were firm, although as compared with a week ago they have lost a few pence. The results are due next month and there are anticipations that the improvement in profits shown for the previous year has been continued. An increased

dividend is looked for in the market, although not more than 5 per cent. is expected. For the previous year 2½ per cent. was paid. Anglo-Iranian and other leading oil shares have not retained best prices, but they continued to receive considerable attention on the view that an increase in British petrol prices is likely before long.

Prices of Chemical Products

This Week's Market Conditions

THERE are no price changes to report in the markets for rubber chemicals, wood distillation products, perfumery chemicals, essential oils and intermediates. With the exception of the items mentioned below the prices of all other chemical products remain as reported in *THE CHEMICAL AGE* last week (pages 60-61).

MANCHESTER.—The death of His Majesty King George has cast a gloom over all markets in the Manchester district and the session of the chemical section on the Manchester Royal Exchange on Tuesday, usually the most important of the week, was curtailed and little business was transacted. The consumption of chemicals locally, however, keeps up on a fairly satisfactory scale, and an improving tendency is reported in some quarters in the demand for textile chemicals both in Lancashire and the West Riding centres. New orders this week have not been very substantial, though this is largely accounted for by the fact that the leading users are already well booked for some time ahead. Although prices are well maintained in the by-products market as a whole, the most important development this week has been a decided reaction in crude carbolic values which has brought quotations more into line with what makers of crystals are able to secure.

SCOTLAND.—Business in chemicals has been rather quiet during the week both for home trade and export. Prices generally continue very steady at about previous figures, though zinc and lead products are rather easier in sympathy with the metals.

General Chemicals

ACID, ACETIC.—40% technical, £17 15s. per ton **LONDON**: Tech., 80%, £33 5s. to £35 5s. per ton; pure 80%, £35 5s. to £37 5s.; tech., 40%, £17 15s. to £19 15s.; tech., 60%, £25 15s. to £27 15s. **SCOTLAND**: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech., 80%, £38 5s., d/d buyers' premises **Great Britain**. **MANCHESTER**: 80%, commercial, £37 5s.; tech., glacial, £50.

ACID, LACTIC.—**LANCASHIRE**: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80%, by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

AMMONIUM, SULPHATE.—Neutral quality, 20.6% nitrogen, £7 per ton.

POTASSIUM, PRUSSIATE.—**LONDON**: Yellow, 8½d. to 8½d. per lb. **SCOTLAND**: Yellow, spot, 8½d. ex store. **MANCHESTER**: Yellow, 8½d. to 8½d.

SULPHATE OF COPPER.—**MANCHESTER**: £14 17s. 6d. to £15 per ton f.o.b.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 6½d. to 7½d. per lb.; crude, 60's. 1s. 11½d. to 2s. 2½d. per gal. **MANCHESTER**: Crystals, 7½d.; crude, 2s. 3d. per gal. **SCOTLAND**: 60's, 2s. 6d. to 2s. 7d.

CREOSOTE.—**B.S.I.** Specification standard, 5½d. per gal. f.o.r. Home, 3½d. d/d. **LONDON**: 4½d. f.o.r. North; 5d. London. **MANCHESTER**: 4½d. to 5½d. **SCOTLAND**: Specification oils, 4d.; washed oil, 4½d. to 4½d.; light, 4½d.; heavy, 4½d. to 4½d.

Pharmaceutical and Photographic Chemists

ACID, ACETIC.—Pure 80%, £35 5s. per ton.

CHLOROFORM.—2s. 6d. to 2s. 11d. per lb.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—H.M. Trade Commissioner at Johannesburg reports that the Union Tender and Supplies Board is calling for tenders, to be presented in Pretoria by February 14, 1936, for the supply of 50,000 lbs. of plumbers' metal and 25,000 lbs. of soft solder. (Ref. T.Y. 5640.)

Germany.—A firm established at Bremen wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of red lead for ship-painting purposes. (Ref. No. 59.)

Egypt.—The Commercial Secretary to the Residency, Egypt, reports that the Survey of Egypt, Giza (Mudiriyah), Cairo, are calling for tenders, to be presented in Cairo by March 30, 1936, for the supply of photographic chemicals. (Ref. T.Y. 10356.)

Mexico.—A commission agent in Mexico City desires to represent a United Kingdom manufacturer of bituminous anti-corrosive paint. (Ref. No. 66.)

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